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Prepared for:
Product Safety Branch
Department of Consumer
and Corporate Affairs
Ottawa, Ontario

The Regulation of Flame-Resistance of Tentage:

The Technical and Socio-Economic Impact On Canadian Industry

FINAL REPORT

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CSI-215
GTH/cb
November 1984

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This report is not a Socio-economic Impact Analysis (SEIA) as defined by Treasury Board Canada.

The views expressed are those of the author and not necessarily those of Consumer and Corporate Affairs Canada.

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1.0 EXECUTIVE SUMMARY

1.1 In July 1984, ADGA Systems International Limited was awarded a contract by the Product Safety Branch, Department of Consumer and Corporate Affairs to study and report on a proposed regulation to ensure that all tents and similar products manufactured, imported and sold in Canada will meet a given standard for flame-resistance. The proposed regulation excludes marquees and large assembly tents which fall under the provisions of the National Building Code, but it does include camping tents, children's play tents, canvas trailer tops and similar structures produced from textile and other materials.

1.2 The objective of this program was to review and assess the potential impact on the tent industry of the proposed flammability regulations for tents under the Hazardous Products Act and to examine the concerns raised by industry and other associated parties. This included a review and assessment of technical and production problems associated with the manufacture of flame-resistant tentage and tentage materials and an assessment of the economic impact of introducing mandatory flame-resistance in tentage. The study also was to examine the experience of other countries which have introduced voluntary or mandatory standards to govern the flame resistance of tents, shelters and their materials. The detailed Statement of Work is given in Section 1.2 of the report.

1.3 The findings are related to the specific requirements of the Statement of Work. Useful information not related to the specifics has been included in the report in the form of observations. Because the sequence and numbering of this summary is necessarily different to that of the report, references to the relevant part of the report are included.

2.0 DATA-GATHERING (Report Section 2.0)

Information was obtained from Canadian industry, importers, the retail sector, research agencies and government organizations. Contact was also made with companies and organizations in the United Kingdom and the United States. In addition information was sought from those engaged in the development of standards for flame resistant tentage materials in eleven other countries. The response from the data sources was variable. In the case of some of the areas outlined in para. 1.2 of the report, information had either never been recorded, was not made available or was limited in depth because of the time-frame of the project. Despite this, sufficient information has been compiled to substantiate the conclusions and recommendations which have been made.

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (Report Section 3.0)

3.1 The situation regarding regulations on flame-resistant tentage in other countries is best exemplified by the experience of USA and that of the United Kingdom. In USA mandatory regulation was introduced in seven states at various times in the early 1970's. The industry was initially resistant to the new requirement but produced its own standard, known as CPAI-84, which was adopted by the seven states. As the industry acquired technology and equipment and carried out the necessary development work, a phase which took three and one half years, the tent manufacturers realized that it would be more effective and efficient to supply flame-resistant tents nation-wide. Mandatory regulation within seven states resulted in nation-wide sales of flame-resistant tents.

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (cont'd) (Report Section 3.0)

3.2 In the United Kingdom, a British Standard was introduced which set the requirements and acceptance levels for flame-resistance in tents. It was not a mandatory regulation and, as a result, practically no British manufacturers or retailers have voluntarily adopted the standard. The main reason given was that the increase in price would not be accepted and would result in market decline. As a result most flame-resistant tents marketed in Britain today are imported from Europe and the imports account for a significant quantity of all camping tents and similar items sold in the United Kingdom.

3.3 These two situations coupled with the limited data obtained from other countries indicate that a voluntary standard is not likely to be adopted whereas a mandatory standard, with suitable enforcement, would result in the necessary technical and manufacturing changes being made to produce a flame-resistant product.

4.0 FINDINGS (Report Section 4.0)

4.1 Tent Fire Statistics (Report Section 4.1)

Of a total of thirteen countries contacted, only three, Canada, UK and USA, had any statistics on the incidence of tent fires and the injury/death data and in each case, the reporting was incomplete. For a number of reasons the majority of tent fires remain unreported. The fact that there are tent fires some of which result in death and injury is undisputed. The question as to whether or not the

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.1 Tent Fire Statistics (cont'd) (Report Section 4.1)

incidence is sufficiently great to justify regulation is subjective and the response will vary according to the immediate aims of any particular source. The decision to regulate or not is that of the Minister of Consumer and Corporate Affairs and will be based upon the information and data which is made available to the Minister.

4.2 The Nature of the Hazard (Report Section 4.2)

Tent fires can result in injuries to the occupants and it is generally acknowledged that burns are the prime source of concern. However a program conducted by the Department with the support of Health and Welfare Canada has shown that excessive exposure to heat is a serious hazard and could result in death. Levels of carbon-monoxide, carbon dioxide and nitrogen oxides in a tent fire situation could cause injury or incapacitation but are not considered to be potentially fatal except to the chronically ill.

4.3 CPAI-84 as the Basis for a Standard (Report See 4.3)

The CPAI-84 standard for flammability of tentage materials is the specification adopted in USA. It has been proven over a number of years and, if regulation is adopted, CPAI-84 would be acceptable to Canadian industry. There is one modification proposed to one of the test procedures because the Product Safety Branch considers the original procedure could not be enforceable. With that exception, the technical aspects of CPAI-84 would be suitable as a basis for a Canadian standard.

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4.0 FINDINGS (Report Section 4.0)

4.4 Current Technology and Canadian Manufacturing Capability (Report Section 4.4)

The technology of flame-resistant treatments is known but, with few exceptions, it has not been applied in Canada to Canadian-produced textile tentage fabrics or substrates. Because the application of flame-resistant chemicals can adversely affect the physical properties of the textile materials, new substrates compatible with Canadian manufacturing facilities will have to be developed. Canadian industry has the ability to produce flame-resistant tents and tent materials, provided that adequate time is allowed for industry to develop and convert to flame-resistant products.

4.4.1 Processes

There are many processes available and three different types have been identified as they are known to be capable of being applied to tentage fabrics. It is not possible to identify the capital costs associated with these processes as the requirements of each company will differ according to the equipment they currently operate and the type of finish they choose to use. However the type of equipment has been identified, together with the necessary exhaust and dust control systems. Conversion to a flame resistant fabric could be carried out for as little as $25,000 if an adequate exhaust system is already in place. The cost of dust control and exhaust systems is peculiar to the circumstances within each company. Sources of possible federal financial aid have been explored and are reported. (Report Sections 4.4 and 4.5)

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.4.2 No work has been carried out in Canada on the development of materials produced from inherently flame-resistant fibres except for a small series of experimental programs conducted by the Department of National Defence. This approach to flame-resistance has many potential benefits including the permanence of the properties, simple processing and retention of physical properties. This development has been identified as one which could be followed by industry in the future. (Report Section 4.4.21)

4.4.3 Durability of the Treatments

The question of durability of these treatments is one which is addressed by the technical clauses in the proposed Canadian standard. There are some flame-resistant treatments which do deteriorate after prolonged exposure to the elements. There are two test procedures in the recommended standard which will act as a safeguard against such deterioration namely the assessment of flame-resistance after leaching (exposure to water) and after weathering (exposure to water spray and sunlight). (Report Sections 4.3.8 to 4.3.10)

4.4.4 The loss of physical properties of tentage fabrics can be largely overcome by the development of lightweight polyester/cotton materials with higher tensile and tear strength than the current standard cotton fabrics. The loss of physical properties which often occurs after the application of a flame-resistant finish will result in a fabric the residual strength of which is adequate for use in tents. These materials have yet to be developed in Canada.

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.4.5 The occupational health and safety hazards have been discussed with British manufacturers who use two of the three finishes identified in the report. Written evidence is contained in the report which shows that, with adequate dust control systems and high levels of industrial hygiene, there are no serious hazards. (Report Section 4.4.19 and Appendices M and N)

4.5 Cost Increases and the Anticipated Effect on the Market and Employment Levels (Report Section 4.6)

4.5.1 One of the prime concerns of the Canadian tentage industry is that the cost increase occasioned by the inclusion of flame-resistance could result in severe market resistance and possible cessation of business by the tent manufacturing industry and those textile finishers who are largely dependent upon the tent makers.

4.5.2 This has been discussed with industrial sectors and retailers and a number of costing calculations have been made. The increase in the manufacturing cost of a tent to incorporate flame-resistance would vary according to the size and design of the tent and the materials used. The range of increase is estimated to be between 12% and 20% over the cost of a water and rot resistant tent. This applies to canvas tents where over 97% of total Canadian sales are produced in Canada.

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.5.3 So far as nylon tents are concerned over 93% of the Canadian market is supplied by imports. The actual cost increase per tent (f.o.b. country of origin) for the addition of flame resistance ranges between 3.8% and 6.8%.[1] (Report Section 4.6.4)

4.5.4 It is considered that the increase will not have a major impact on the nylon tent market but the canvas tent industry presents a different problem. The increase is sufficiently high to cause market resistance during the first year of implementation of the regulation but recovery to previous levels would take place over the following two years because the only tents available to the consumer will be those which are flame-resistant. However in the interim period between the promulgation of the regulation and its implementation date, the Canadian industry will be vulnerable to increased imports, possibly tents which have inferior flame-resistant properties. It is considered that temporary tariff measures or non-tariff barriers be examined in order to preserve the existing market for Canadian manufacturers during the transitional period. (Report Sections 4.6.2 and 4.7.16)

Note [1]: After this data had been obtained from a major Canadian retailer, the same source has reported that they will be selling flame-resistant nylon tents in the 1985 season for the same price as non-flame-resistant.

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.5.5 The discussion on cost is based upon the increased price of materials. Other areas of cost increase are identified but at this stage they are not capable of being quantified until the actual changes have been effected. (Report Section 4.6.7). Cost figures have been calculated at the manufacturing level. The distribution costs and retail mark-ups vary so widely that it is not possible to project the cost increase to the consumer.

4.5.6 It was not possible to assess the possible promotional value of flame-resistance in tentage. Most of the companies contacted on this issue considered that any promotional value would be more than offset by the effect of the cost increase. (Report Section 4.6.6.12)

4.5.7 If the implementation date does not allow sufficient time for the industry to make the necessary changes, there would be a significant loss of employment. Examples have been reported. Because of fluctuations in the work force and the inability to quantify the total work force in the industry, the loss of employment cannot be expressed as a percentage unless more detailed data is obtained. (Report 4.6.9 and 4.6.10)

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.5.8 One of the tentage materials used in large quantities by the Department of National Defence is purchased in the United Kingdom because Canadian industry did not wish to produce the special substrate and was not able to apply the required water, rot and flame resistant finish to meet specifications. Approximately 100,000 m per year is involved. Once Canadian industry has adjusted to manufacturing to the proposed regulation, it would be in a better position to meet the DND requirement and thus increase the market in the materials sector. (Report Section 4.4.20)

4.5.9 There is also a potential market in USA which could be facilitated by both countries using similar standards of performance. This cannot be quantified at this time but it is a fact that during the US involvement in Vietnam, Canadian industry was supplying tentage materials to US to supplement the American domestic production. The potential markets in other countries could not be explored within the allotted time frame, but the situation in Britain, as an example, would indicate that there are opportunities for marketing Canadian products. (Report Section 4.3.11)

4.0 FINDINGS (cont'd) (Report Section 4.0)

4.5 TIMING (Report Section 4.7)

4.6.1 The key to the whole question of introduction of regulation is the timing of its implementation. Canadian industry is not ready to go into production on flame-retardant tent materials. The various stages leading to production have been examined and a realistic implementation date of 1988 is proposed. There is little or no difficulty in meeting the 1985 deadline for warning labels. In the interim period 1984-1988, it is important that the same standard as that which will prevail on the 1988 implementation date, be used to set the levels of acceptance for tents being sold as flame-resistant. Failure to do so could result in the tents with inferior flame-resistant properties being sold and thus reduce the market for the domestic canvas tent industry and the reputable importers. As mentioned earlier some form of temporary tariff or non-tariff protection is required during this period.

4.6.2 Very little information was forthcoming from other countries regarding costs, time to implement and effectiveness of regulations and standards largely because the only country which has a form of mandatory regulation for camping tents and similar items is USA. The situation there has been outlined in para 3.1 of this summary. Even in the US scenario there is difficulty in obtaining the vast amounts of data necessary to support an in-depth economic study. However sufficient information has been obtained to support the situation in Canada and to forecast the effects of regulation with an acceptable degree of confidence.

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5.0 RECOMMENDATIONS (Report Section 7.0)

5.1 The findings of the study have led to a number of recommendations which are summarized as follows:

5.1.1 The regulation should permit a voluntary period of compliance with a firm date set for mandatory compliance. The voluntary period, which is that between the date of promulgation of the regulation and the date for mandatory compliance, should be sufficient to permit Canadian industry to make the necessary changes.

5.1.2 The safety-related technical requirements of the US standard, CPAI-84, should be incorporated in the Canadian regulation, with one small change in test method.

5.1.3 Industry should take steps to develop new fabric/finish standards, install new equipment where necessary, dust and fume exhaust systems, and plant modernization where required. The industry should also take steps to adopt new technology which applies to the sector.

5.1.4 Industry should approach federal and provincial financial assistance programs to help defray the cost of equipment and product development.

5.1.5 Consideration be given to changing the date for obligatory warning labels from 1 April 1985 to 1 October 1985.

5.0 RECOMMENDATIONS (Report Section 7.0)

5.1.6 Relabelling of carry-over stocks from the 1984 season be accomplished primarily by the use of pressure-sensitive labels applied by the consumer.

5.1.7 The date for mandatory incorporation of flame-resistant properties in all tents manufactured, advertised and sold in Canada should be 1988.

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1.0 INTRODUCTION

This study is being carried out by ADGA Systems International Limited for the Product Safety Branch, Department of Consumer and Corporate Affairs (the Department) under contract dated 4 July 1984. The following objectives and Statement of Work were specified in the terms of the contract.

1.1 Objectives

The objective of this program is to review and assess the potential impact on the tent industry of the proposed flammability regulations for tents under the Hazardous Products Act. This includes a review and assessment of technical and production problems associated with the manufacture of flame-resistant (FR) tentage and tentage materials and an assessment of the economic impact of introducing mandatory flame-resistant in tentage. The study also examines the experience of other countries which have introduced voluntary or mandatory standards to govern the flame resistance of tents, shelters and their materials.

1.2 Statement of Work

The study will include the following areas.

1.2.1 To review and assess the technology of treating tentage materials with flame-retardant chemicals.

1.2.2 To determine the availability of commercial processes and their chemicals for flame-retarding tents in Canada, the United States, the United Kingdom and other countries.

1.0 INTRODUCTION (cont'd)

1.2.3 To review and assess the possible use of inherently flame-resistant fibres in tentage materials and to determine the commercial availability of such materials in Canada.

1.2.4 To determine the effect of the flame-retardant treatments in terms of:

1.2.4.1 The durability of the protection provided;
1.2.4.2 Fabric properties such as tensile and tear strength, sun-light resistance, rot-resistance, water resistance, etc.;
1.2.4.3 The health and safety of workers exposed to flame retardant treatments in the production of tents;
1.2.4.4. Existing production methods and facilities in the Canadian industry.

1.2.5 To estimate the overall cost to Canadian industry to meet the requirements for flame resistance in terms of:

1.2.5.1 Capital costs;
1.2.5.2 Processing costs;
1.2.5.3 Cost of chemicals;
1.2.5.4 Compliance testing;
1.2.5.5 Other significant tangible costs or benefits;
1.2.5.6 Possible application of government industrial development programs to these costs.

1.2.6 To examine the change in the demand for Canadian made tents, in foreign and domestic markets, with regard to:

1.0 INTRODUCTION (cont'd)

1.2.6.1 Cost of production of flame-resistant tents;
1.2.6.2 Improved flame-resistant properties.

Specifically, but not exclusively, the following items should be examined: potential for DND market; potential for increased exportation to the US and other countries; and potential for increased importation into Canada.

1.2.7 To examine the time factors involved for the manufacturing industry and the retail sector to implement regulations enforcing the manufacture and sales of flame-retardant tentage.

1.2.8 To examine existing regulations and standards in the United States, the United Kingdom, Germany, Australia and other countries in terms of:

1.2.8.1 Costs;
1.2.8.2 Time to comply;
1.2.8.3 Impact on the industry;
1.2.8.4 Effectiveness of regulations or standards;
1.2.8.5 Applicability to the Canadian situation.

1.2.9 To examine other significant tangible costs or benefits that may arise during the study.

Note: The Objectives and Statement of Work use the terms "flame-retardant" and "flame-resistant". A number of interpretations of these and similar terms have been made by numerous authorities over a long period. For the purpose of this study only, the two are regarded as being synonymous and for the sake of clarity the term "flame-resistant" (FR) has been used in the remainder of the report.

1.0 INTRODUCTION (cont'd)

1.3 Background

1.3.1 In Canada marquees and public assembly tents are required to be flame-retardant in accordance with the provisions of the National Building Code.(1) Not all sources make the distinction between these tents and the smaller, lightweight structures. Some materials are common to both sectors of the industry and many manufacturers produce both classes of tents.

1.3.2 The Product Safety Branch of the Department of Consumer and Corporate Affairs (referred to as "the Department") had studied the problem of flammability of tentage for a number of years and broached the question of a federal regulation to govern flame resistance of tents at a meeting held with industry, government representatives and other interested parties in 1977. This constituted what was virtually a statement of intent to regulate, and the Department then carried out a number of preliminary steps including an investigation of test methods and the collection of statistics. At a meeting on 28 October 1983 at which industry was well represented, the Department announced its intention to recommend the introduction of regulation. The department had not acted earlier for a number of reasons which included the work on statistics and test methods, together with a related problem of adopting a standard which was not overly severe for nylon tent materials. Another

Note:(1) National Building Code of Canada 1980. Issued by the Associate Committee on the National Building Code, National Research Council. Ottawa. NRCC No. 17303.

1.0 INTRODUCTION (cont'd)

1.3.2 (cont'd)

reason was a wish to determine if industry would take steps to voluntarily include flame retardance in their product characteristics.

1.3.3 By 1983 a move to voluntarily adopt flame-resistance within the industry had not taken place, primarily because of the additional cost of the finished product and also because industry appeared to be waiting for further government action and did not wish to precipitate it. When the Product Safety Branch informed the meeting on 28 October 1983 of its intentions, the industrial members appeared to be taken by surprise. This turned to either resistance or resignation. A number of arguments were raised in opposition to regulation including:

- The available statistics on tent fires did not demonstrate a sufficiently critical problem to warrant regulation.
- The increase costs would result in adverse market reaction and the tent industry would cease to exist.
- The health and safety hazards associated with processing FR materials had not been determined.
- No other country had adopted a mandatory regulation for FR tentage and only seven states in USA had introduced obligatory flame-resistance.
- Other hazards are more critical than flammability of tents and these should be given priority in regulatory action.

1.0 INTRODUCTION (cont'd)

1.3.4 Further meetings were held between government and industry representatives in Feb. 1984 and July 1984. In the meantime in late May 1984 the Department decided to commission a study to determine the technical problems and the socio-economical impact of the proposed regulation on the various branches of industry. This was followed by an announcement on 5 June 1984 by the Minister of Consumer and Corporate Affairs that she had decided to introduce a regulation calling for a mandatory warning label to be affixed to all tents sold in 1985. All tents marketed in 1986 were to be flame-retardant. (Appendix A) At the 5 July 1984 meeting the announcement was made that a contract had recently been let to ADGA Systems International Ltd., Ottawa to conduct the aforementioned study. Mr. G.T. Holmes is the ADGA project manager.

1.4 The Canadian Industry

1.4.1 The Department has reported that there are about 90 companies with the capability to manufacture tents, but only 15 companies do so on an ongoing full-time basis. The industry is extremely price-sensitive because in most product lines it is competing for business in the recreational field. The consumer normally only buys recreational goods once the basic needs have been provided (food, shelter, clothing, etc.)

1.0 INTRODUCTION (cont'd)

1.4.2 The impact of the import market also contributes to competitiveness and price sensitivity particularly as most imports are from sources in the Far East, where labour costs are much lower than those in Canada. Statistics Canada, in their publication 65-207, records that the number of tents imported into Canada has been fairly constant over the past five years at 230,000 ± 30,000 tents (average ± standard deviation). The dollar value of these imports (in 1982 dollars) was $5.5 million ± $1.1. million per year expressed in constant 1982 dollars. In 1982 the major sources were Taiwan and South Korea with 95% of the market. United States had 4% and Czechoslovakia 1% of the Canadian import market.

1.4.3 While the imports account for the larger part of nylon tent sales in Canada, the domestic industry has most of the market for canvas tents, using 100% cotton fabrics up to this point in time. In 1982 approximately 92,500 cotton tents were sold in Canada with a value in 1982 dollars of $12.739 M. While Canada held over 97% of this market by volume, only 6.6% of the nylon tents on the market were made in this country. These data are contained in Appendices B and C. The figures represent shipments from industry, tents on the market and imports: actual sales figures are not available, but if carry-over from one season to the next is reasonably constant, sales should equal shipments and imports.

1.0 INTRODUCTION (cont'd)

1.4.4 If the domestic industry is to remain viable, it must retain that part of the market it now enjoys. If the market share can be increased, there will be greater benefits to the economy of this industry, but the importers would be providing the offsets because there is no data to indicate that camping is significantly increasing in popularity, thus creating new markets. The military is probably the largest single customer of the industry and it often demands the incorporation of the latest technology. DND procures most of its tentage materials in the United Kingdom because Canadian industry will not or can not produce the polyester/cotton corespun fabric with its dry water, rot and flame resistant finish. The need to utilize new technology and manufacturing processes is self-evident. It is estimated that at least 100,000 m. of material production for military use is lost each year by Canadian industry. In time of national emergency this could jeopardize the national defence effort.

2.0 DATA GATHERING

2.1 A total of 50 contacts were made, broken down in the following geographical categories:

Canada	27
United Kingdom	9
United States of America	3
Other countries	11

2.2 Constraints of time and funds did not permit individual visits to all contacts, however, of the 39 located in Canada, United States and United Kingdom, face-to-face discussions were held with 26 organizations and companies. Most of the others were contacted in writing and were invited to complete a questionnaire and submit their comments and opinions. A few companies did not respond to the questionnaires. The contacts were representative of those organizations who have a role to play in implementation of a regulation or who can contribute to the subject. Copies of questionnaires sent to other countries and to Canadian industry not contacted personally, are attached at Appendices D and E. The full list of contacts is contained in Appendix F.

2.0 DATA GATHERING (cont'd)

2.3 The organizations are categorized in Table 1.

TABLE 1

DATA SOURCES BY CATEGORY

	Canada	USA	UK	Other Countries	Total
Textile Manufacturers and Finishers	3	--	1	-----	4
Finishers(Proofers)	3	1	1	------	5
Tent Manufacturers	13		1	------	14
Manufacturers of Flame-retardant Chemicals	----	----	1	-----	1
Importers	1	----	------	-----	1
Major Retailers	3	----	----	------	3
Research and Development Organizations	2	1	1	-------	4
Other Associations and Data Sources	----	1	2	------	3
Government Agencies	3	----	2	-----	5
Members of ISO TC 38/ SC19/WG4 (Textiles for Industrial Uses and Tentage)	2(1)	----	2(1)	11(2)	11 (exc. Canadian and UK members)

Note (1): The International Organization for Standardization (ISO) members are already included in one of the other categories.

(2): The selection of contacts in other countries was made on the basis of membership in ISO TC38/SC19/WG4. These eleven working group members could also be shown in other categories.

2.0 DATA GATHERING (cont'd)

2.4 With few exceptions, all companies and organizations contacted were most cooperative and frank. They were eager to contribute to the study, largely because they felt that the investigation represented an opportunity to freely express their opinions, concerns and problems associated with regulation. On some issues, a number of companies wished to have their response treated with confidentiality. When these requests have been made they have been respected and the source has not been identified by name. When confidentiality has not been requested, the source of the information has often been identified.

2.5 Some of the organizations cited situations in other product areas which, in their opinion, would warrant regulatory action. These examples were used to demonstrate that the regulation of FR tentage is not necessarily a priority requirement when compared to other hazardous products. Some of these areas are already the subject of regulatory activity, and include children's sleepwear, bedding, mattresses and floor coverings. It is extremely difficult, if not impossible to make valid comparisons of the extent and critical nature of different hazards because such assessment is subjective. There are no thresholds which determine the stage at which a situation is critical and deserving of regulation. The substance of these observations have been recorded here, but the matter of flame-resistance of tentage must be considered as a stand-alone issue in the context of the objectives of this study.

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES

3.1 For the purpose of this discussion, it would be useful to briefly examine three types of regulation namely mandatory, voluntary and a combination of the two.

3.2 A mandatory regulation is obligatory to all who are party to it. Failure to comply can result in sanctions and legal proceedings. In this particular instance a mandatory regulation will result in action but, unless it is properly timed, it could have a severe detrimental effect on the industry, as is discussed later.

3.3 In the United States in the early 1970's seven states introduced mandatory regulation to govern flame-retardant tentage. These were seven of the more populous states in which camping is a well-followed activity. The United States tentage industry faced the problem of providing FR for seven states and non-FR for the others. The problem was compounded when selling to major chain retailers as these companies distributed their products across the nation. The United States tent industry therefore gravitated to a flame-resistant product marketed in all states. Non-FR tentage is now a very small portion of total business (approximately 5%) and it is often confined to local sales. Thus mandatory regulation for FR tentage in seven states has engendered the adoption of flame-retardant tentage on a nation-wide basis.

3.4 Voluntary regulation is in fact a voluntary standard and it imposes no legal obligations on the textile manufacturer, tent manufacturer, retailer or consumer to adopt flame-retardant tentage. Some countries have voluntary standards which state in effect that, if a company is to produce or sell tents of low flammability, these are the standards which should be met.

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (cont'd)

3.5 A good case in point is the United Kingdom which has British Standards BS6341, Fabrics for Camping Tents and BS 5576, Safety Features of Camping Tents. The Home Office, Department of Trade and Industry, the proofers and the tent manufacturers freely admit that the standards are disregarded and none could provide evidence that they were being met even for a small part of the market. This attitude is found in an area where there is a need to keep abreast of technology and be innovative and this has undoubtedly contributed to the loss of a large part of the camping tent market to continental European industry. Voluntary standards have made little impact in the United Kingdom. Mandatory standards might have given the industry the motivation it needed to improve its product and its market position.

3.6 A combination voluntary/mandatory regulation is really a phased introduction of a mandatory requirement introduced after a predetermined voluntary period. During the time when the regulation is voluntary it exists as a guide and industry and the retail sector can meet it if they so wish, once they have the capability to do so. This approach is particularly useful when industry needs to make technical and manufacturing changes in order to meet the requirements of the regulation.

3.7 The argument could be raised that there is no requirement for a voluntary period and that a mandatory regulation with a feasible implementation date would suffice. The danger with this approach can be found in the transitionary period, between promulgation of the regulation and the implementation date. It is possible, indeed probable, that during this period FR goods could be marketed which are inferior to those demanded by the mandatory standard. They could be advertised as

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (cont'd)

3.7 being flame-retardant and their inferior performance could result in false confidence on the part of the consumer and an undermining of the credibility of the standard when it is eventually mandated.

3.8 The technical standard should therefore prevail during the transitional period on a voluntary basis and any promotion and advertising claiming flame-resistance should only be permitted if the product meets the standard.

3.9 The situation in the United States and United Kingdom has already been outlined. With regard to all countries contacted Table 2 summarizes the situation concerning regulation:

TABLE 2. STATUS OF REGULATION IN THIRTEEN COUNTRIES

	Camping and Small Tents		Marquees and Tents For Large Assemblies		
	Mandatory	Voluntary	Mandatory	Voluntary/	Remarks
Australia	Yes (1)		Yes (2)		
Austria		No response			
Belgium	No	No	Yes	No	
Denmark	No	No	Yes	No	
Finland (3)	No	No	No	No	
France (4)		No response			
Japan	No	Yes(5)	No	No	
Netherlands	No	No	No	No	Some FR tentage is manufacture
South Africa	No	No	No	No	
Switzerland	No	No	No	No	
West Germany	Yes(6)	No	Yes	No	
United Kingdom	Yes(7)	Yes	Yes	No	
United States	Yes	No	Yes	No	

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (cont'd)

NOTES:

1: Children's play tents must be FR in New South Wales.
2: Marquees and tarpaulins must be FR in New South Wales.
3: Work to produce national FR regulations and standards has commenced in Finland.
4: France replied that there was insufficient time to make a response.
5: Canopies and awnings are also covered by a voluntary FR standard in Japan.
6: FR children's play tents are regulated in West Germany under the Equipment Safety Act.
7: In the United Kingdom it is mandatory that children's play tents be FR.
8: See para. 3.3 for an explanation of the impact of mandatory regulation in seven states.

3.10 Three of the countries have made flame-resistance in children's play tents obligatory on either a federal or state basis. Six countries have mandatory regulation of flame-retardance in marquees and large assembly tents. None of the countries contacted have yet introduced mandatory regulation for flame-retardance in camping tents but two countries have a voluntary regulation. My previous comments on the lack of effectiveness of a voluntary regulation pertain at this stage of discussion. With the exception of USA, none of the countries contacted could offer information on the time and cost factors.

3.11 It is emphasized that a regulation will not prevent tent fires, although it would probably increase public awareness for safety precautions. An effective regulation would help to reduce casualties from tent fires.

3.0 REGULATORY OPTIONS AND THE STATUS OF REGULATIONS IN OTHER COUNTRIES (cont'd)

3.12 Recommendation

As there would appear to be much to be gained by both government and industry in jointly attacking this problem by adopting the voluntary/mandatory format or a format which has the same effect, it is recommended that this form of regulation be followed. However the date of mandatory implementation must be predetermined and made public, otherwise all the pitfalls associated with voluntary standard will be perpetuated.

4.0 FINDINGS

4.1 TENT FIRE STATISTICS

4.1.1 Of the fourteen countries contacted only three had any statistics to offer on the incidence of tent fires and the death/injury rate. These were Canada, USA and UK.

4.1.2 It was apparent that, even in those countries only a small percentage of tent fires are reported. For example:

- One US source obtains its data from the emergency departments of selected hospitals;
- Another US source only receives data on tent fires if they have resulted in a case in a court of law.
- A third US source, the University of Minnesota, obtained its information largely as a result of personal enquiry and investigation because there was no central federal source and limited data was available from a limited number of states.
- In UK a tent fire is included in the Home Office statistics only if a local fire brigade has been called. There is no other data source.
- Canadian data was collated by the Product Safety Branch Department of Consumer and Corporate Affairs (with the exception of data obtained from the Department of National Defence) using whatever provincial sources which existed. There is no standard method of reporting province to province nor is there a standard responsibility centre. The content and detail of the reports vary and it is generally acknowledged that these constraints and differences prevent the comparison of data between sources, however a general overview of the magnitude of the problem can be obtained.

4.0 FINDINGS (cont'd)

4.1.3 A summary of the data is shown in Table 3.

TABLE 3. Summary of Available Statistics on Tent Fires

SOURCE	Total Reported Tent Fires	Persons Dead	Persons Injured
Canada (1)			
Total Reported (1972 - 1983)	151	32	40
DND data (5 yr. total 1979-83)	33	0	6
United Kingdom			
1974 (9 months)	48	0(2)	11(2)
1979	26	0	11
1982	58	3	20
United States of America			
U. of Minnesota Research (29 states 1948-74)	75	27	92
NEISS (1) 1974-75 (12 mos)	N.A.	N.A.	94
NEISS (1) 1974-75 (12 mos) (Play tents and tunnels)	N.A.	N.A.	5

Note (1) The Canadian total does not include the incidents reported by the Department of National Defence (DND).

Note (2) The death/injury data refers to 21 of the total fires, involving ridge and frame tents.

Note (3) The National Electronic Injury Surveillance System (NEISS) is operated by the US Consumer Product Safety Commission's Bureau of Epidemiology. It obtains its data from 119 statistically selected hospital emergency rooms located throughout USA and refers to all tent-related injuries. This data, while interesting is not sufficiently specific to allow an opinion to be formed.

4.0 FINDINGS (cont'd)

4.1.4 The British data is pertinent and copies of the reports are attached (Appx. G, H and J). Data from other years was requested but up to the time of publication of this report, it had not been received. These tent fire incidents are only those in which a fire brigade was called. There is nothing to indicate what the total number of tent fires might be in each year. In all probability the total number of tents destroyed or damaged by fire could be many times the figures reported by fire brigades and thus property damage would be correspondingly higher. However, monetary loss is not an issue particularly as a fire in a flame-resistant treated tent would still result in property loss or damage.

4.1.5 It can be argued that the total incidence of deaths and injuries will not proportionally increase at the same rate as the number of tent fires as the majority of fatalities and injuries could have occurred in those cases in which the fire brigade was called. I cannot subscribe to this interpretation. Evidence from Canada, USA and UK shows that tents burn very quickly and this hardly gives time for a fire department to be called. In addition camping tents are not normally used in urban areas in which fire fighting facilities are available. It is therefore emphasized that the figures quoted in the British data represent a percentage of the total, but it is impossible to determine the actual factor to be applied to the data in order to accurately estimate the actual total incidents, deaths and injuries.

4.0 FINDINGS (cont'd)

4.1.6 The only data from USA which can be regarded as pertinent is that which was collected by Dr. R.F. Johnson and his associates at the University of Minnesota. Although the 75 reported incidents occurred in the period 1948 - 74, the majority of them (59) took place in the period 1970-74. Approximately 82% of the deaths and injuries took place during this period. The data has been analyzed in some detail and it is attached as Appendix K to this report. Again the research team had to utilize whatever sources they could in the absence of central data-collection agencies. They contacted a state fire marshal, hospital burn units, attorneys, court officials, national park officers and the US Consumer Product Safety Commission. It is not known if this was a representative sample or not and it is considered that it would be dangerous to attempt linear extrapolation in an effort to estimate the national figures.

4.1.7 Canadian data is that which has been collated by the Product Safety Branch, Consumer and Corporate Affairs [1][2] and that obtained from the Department of National Defence. As was the case in USA, the Canadian researchers had to use a variety of sources, the most productive being Provincial Fire Marshals' and Fire Commissioners' offices, Provincial Coroner's offices, media reports and individual contacts with consumers. The detailed information is too voluminous to be included in this report but it can be made available by the Department.

(1) Tent Fire losses in Canada: Statistics and Estimates. Flammability Hazards Division, Product Safety Branch, Consumer and Corporate Affairs, January 1984.

(2) Addendum to Tent Fire Losses in Canada: Statistics and Estimates. Report L 10027-T66-1, Sept. 1984.

4.0 FINDINGS (cont'd)

4.1.8 Knowing the characteristics of tent materials used during the periods under report it is highly probable that all tent fires report by UK, USA and Canada (excl. DND) were in respect of tents which were not made from flame-resistant materials. In all three countries, there are reported deaths and injuries from tent fires. It is impossible to determine the significance of the figures because in no case is there information as to the ratio of reported incidents to the total actual incidents.

4.1.9 The one exception is the information obtained from National Defence. All tent fires are reported and are the subject of investigation. The data is therefore 100% complete. In addition it is known that, of 33 fires, 20 involved Arctic tents which have an inherently flame-resistant liner, 12 occurred in modular tents with a fire, water, weather and mildew resistant (FWWMR) finish and only one involved a non-FR tent. Canadian military personnel use naptha-fuelled Coleman stoves and lanterns inside the tents. Cooking is carried out inside the tents and candles are issued and used, particularly in the Arctic tents. These conditions of use create a greater hazard than those found in civilian usage. Despite this there have been no deaths and only six injuries in the 33 fires, the lowest incidence reported from any source. This reflects favourably on the use of flame-resistant tentage and in the absence of "before FR" and "after FR" data from any source the improved behaviour outlined in the DND statistics can be attributed in some measure to the FR materials used.

4.0 FINDINGS (cont'd)

4.1.10 Canadian industry members have suggested that the incidence of deaths and injuries could be too low to warrant regulatory action. They suggest that warning labels and an education program for the consumer would have a similar effect to mandatory regulation. The interpretation of statistics which are difficult or impossible to analyze is subjective. This particularly applies to the partial data available on tent fires. Using the same statistics the various interpretations could run from one extreme to the other. It is not possible to state that x number of deaths and injuries from y number of fires is sufficient or insufficient to warrant regulation.

4.1.11 Because some of the Canadian contacts consider non-regulation to be one of the options, this fact is recorded. However the terms of reference for this study require the examination of the effects of regulation on the various sectors of industry and in order to do this, it is necessary to pre-suppose that regulation is to be legislated. It is considered that non-regulation would only be considered if the industry has voluntary changed to FR products: even then there is no guarantee that in times of economic pressure, the FR characteristic would not be dropped. Experience in other countries indicates that an ongoing voluntary program has little chance of successful implementation. Even in USA, industrial change was precipitated by mandatory regulation.

4.0 FINDINGS (cont'd)

4.1.12 Causes of Fire

Again little data is available from some of the sources and all that can be done is to record the causes so that they are recognized in any cautionary label or literature.

United Kingdom 1982

Cooking Appliances	17
Smoking Materials	11
Heating Appliances	4
Lighting Appliances	2
Refrigerators	1
Other Appliances	3
Burning Rubbish	1
Blow Lamp	1
High Tension Cable	1
Spread from Another Fire	1
Unknown	16
	58

DND 1979 - 84 (5 years)

Coleman Lamps	11
Miscellaneous (Other Causes)	22
	33

Canada (CCAC)

Open Flame (match, lamp, candle)	31
Heating Equipment	24
Outside Sources (Campfire, etc)	16
Cooking Equipment	10
Electrical Equipment	6
Smokers' Materials	5
Miscellaneous	6
Unknown	29
	127

4.0 FINDINGS (cont'd)

4.1.13 These figures indicate that the main causes or ignition sources of tent fires are:

Cooking Appliances
Open Flames (candles, campfires, etc.)
Heating Equipment
Low Pressure Gas Equipment
Smoking Materials

The proposed warning label makes reference to these hazards and therefore it should be adequate as a precautionary measure.

4.2 THE NATURE OF THE HAZARD

4.2.1 Casualties caused by burns are a prime source of concern but the hazard of the toxicity of the thermal degradation by-products is a very real possibility. The Product Safety Branch conducted a series of controlled burning tests on tents and the Department of Health and Welfare made a letter report on the results to the Product Safety Branch, Consumer and Corporate Affairs on 4 July 1984. An oral report was also given by Health and Welfare to the government/industry meeting on 5 July 1984. The findings of the report showed that:

a. In general, burning cotton-type tents generated more carbon-monoxide than nylon tents, but the levels recorded were unlikely to cause asphyxiation. There could be a risk for "oxygen-stress-responsive" chronically-ill campers.

4.0 FINDINGS (cont'd)

b. The levels of carbon dioxide and nitrogen oxides were higher in cotton tents than in nylon tents, but were below the critical level.

c. Combustion temperature was considered to be a serious hazard, particularly in cotton tents. Recorded temperatures in excess of the lethal limit of 121°C were recorded in the burning tents.

4.2.2 The report stated:
"In general the acute exposures to C0 and $C0_2$ in burning tents are unlikely to cause death. Any adverse health effects from gases are completely overshadowed by excessive exposure to heat. In nylon tents the $N0_x$ generated could cause damage to pulmonary epithelium and an accumulation of pulmonary edema, followed by impairment of gas exchange".

4.3 CPAI-84 AS THE BASIS FOR A STANDARD

4.3.1 The CPAI-84 Specification for Flame-Resistant Materials used in Camping Tentage was developed by the US Industrial Fabrics Association International in 1972. As regulations for flammability in tentage were being legislated on a state by state basis it became obvious that the industry could not respond effectively to a number of different standards and an industry-wide standard was necessary. By the same token the major chain stores could not buy and distribute tents across the retail network on the basis of selection of products for each individual state. CPAI-84 was therefore devised and adopted by the US canvas goods industry and by their customers. State regulations accepted and adopted this standard. A copy is found at Appendix L.

4.0 FINDINGS (cont'd)

4.3.2 CPAI 84 is not necessarily the ideal standard. Dr. M. Day, Division of Chemistry, National Research Council criticizes the use of a specimen with a raw edge in that it does not resemble the real-life situation. This is true and it is a situation found in most FR tests which use a vertical strip. On the other hand the number of tent fires which start on a free hemmed edge must be of a very low order. Research indicates that in most cases the flame impinges on an vertical wall or an inclined roof section. There would therefore appear to be grounds for considering an ease of ignition test on both an inclined plane and a vertical specimen. However, rate of burning tests which also identify the extent of burning are also necessary.

4.3.3 In a report on Tent Flammability[1] the Ontario Research Foundation presented comparative test data using four different methods. The report stated: "On the basis of the above conclusions, it is proposed that CPAI-84 should be considered as the basis for regulating the use of tenting materials in Canada." and "Tents manufactured from materials which meet the standard CPAI-84 do not present an undue hazard even when exposed to severe ignition sources."

(1) H.J. Campbell and M.J. Williams, Tent Flammability. Ontario Research Foundation. 20 October 1977.

4.0 FINDINGS (cont'd)

4.3.4 At meetings on the subject of tent flammability, sponsored by the Department of Consumer and Corporate Affairs, industry members have stated that, if regulation was to be adopted, they would prefer to utilize CPAI-84 as the Canadian standard. Some of the reasons for taking this position are:

- The standard has been in existence for a number of years and it is nationally accepted in USA.
- When and if amendments are required in USA, it is the industry which normally takes the initiative.
- It is not a standard which has been imposed upon the industry.
- It facilitates trade between finishers, tent manufacturers and retail outlets in USA and Canada and also helps the promotion of international trade.

4.3.5 As the result of the series of Canadian meetings on tent flammability and the normal between-meeting activities of the Department of Consumer and Corporate Affairs, the currently proposed standard departs from CPAI-84 in three significant technical areas:

- The requirement for weathering specimens and then testing them for flammability has been omitted.(1)
- The measurement of the damaged length in wall and roof material has been omitted.(1)
- A requirement has been added for the measurement of time-to-burn the entire specimen, a minimum time of 16.0 secs being used.(1)

(1) Discussion of these changes can be found in the minutes of the Consumer and Corporate Affairs Canada Tent Flammability meeting, 28 Feb. 1984.

4.0 FINDINGS (cont'd)

4.3.6 The weathering requirement was omitted because at that point in time it appeared that the time and money spent in testing would only result in marginal benefits. (The procedure costs approximated $350.00 per sample.) The measurement of the damaged length was deleted because it pre-supposes that the untreated weight of the material is known. This is not necessarily so, particularly in the case of imported items. The credibility and accuracy of the test method is therefore jeopardized. It would be difficult to enforce this provision.

4.3.7 The measurement of time-to-burn has been added to replace the determination of damaged length. The Product Safety Branch states that, according to their laboratory tests to date, materials which meet the time-to-burn test also meet the CPAI-84 damaged length test. This being so, the change in test method should not have an adverse effect on the ability to trade with USA. It should also be a less expensive test method.

4.3.8 Deletion of the weathering requirement for non-technical reasons can be dangerous. Dr. M. Day (National Research Council) has emphasized the need to retain the weathering clause in an unpublished communication dated 28 Feb. 1984. He made reference to a number of studies in UK and USA which demonstrated that all FR finishes do not behave in the same manner after exposure to weathering. One widely-used FR treatment suffered significant loss of finish after weathering with a resultant lowering of flame-resistant properties.

4.0 FINDINGS (cont'd)

4.3.9 This type of behaviour was reported in discussions with other technical personnel. It is imperative that the consumer, the retailer, the importer and the manufacturer be protected from a secondary hazard caused by deterioration of the flame-retardant properties. This is especially so in the case of imports because the importer is largely at the mercy of his overseas sources and has little or no control over them.

4.3.10 Dr. Day is of the opinion that the weathering clause should be retained despite the cost of testing. This opinion agrees with that of all Canadian, American and British organizations with whom it was discussed and it coincides with my own opinion on the matter.

4.3.11 USA and Canada are currently examining the possibilities for US - Canada free trade agreements in a number of sectors, one of these being textiles and items produced from textile materials. While the road to free trade must avoid conflict with the principle of non-discrimination contained in Article I of GATT this international agreement does not prevent the formation of a free trade area or a customs union. It is a fact that Canada has exported tents and tentage materials to USA in the past and during the Vietnam war USA needed Canadian production to maintain stocks of military tents. If a form of free trade would open up markets for Canadian production the adoption of existing US standard, (CPAI-84) would facilitate the sale of Canadian goods.

4.0 FINDINGS (cont'd)

4.3.12 Let us detail the courses open:

1. If CPAI-84 is adopted in full, there will be a proven standard, acceptable to all users of it and it will facilitate trade between USA and Canada.

2. If a lower standard is adopted it will be almost impossible for Canada to export to USA but it will make the entry of imports from Far East countries more easy.

3. If a higher standard is selected, imports from other countries into Canada would be more difficult. However it could present technical and production problems for Canadian industry in meeting the levels of acceptability.

4. If Canada was to adopt a standard which is basically different to CPAI-84, it would be time consuming and a duplication of effort to devise and approve the standard. In any event it would create serious difficulties for the domestic industry and importers alike.

5. If a standard which is equal in technical accuracy and effectiveness to CPAI-84 is adopted it would have much the same effect as #1 (adoption of CPAI-84 in full), with the advantages associated with that option.

4.3.13 Recommendation

For reasons outlined in the above discussion it is recommended that the safety-related technical requirements of CPAI-84 be adopted. These will include the requirement for weathering and will substitute the time-to-burn test for the determination of damaged length test.

4.0 FINDINGS (cont'd)

4.4 CURRENT TECHNOLOGY AND CANADIAN MANUFACTURING CAPABILITY

4.4.1 Before discussing the capability of Canadian industry, it would be of benefit to briefly review the current situation in the United Kingdom and the events which have taken place in the United States in recent years.

4.4.2 The regulation process in the United States started in May 1972 in the state of Michigan and in the following five years, six other states had introduced a form of mandatory regulation. However in 1972 the United States industry was not prepared for a massive change to FR tentage. A great deal of technical work had to be accomplished. The United States Army had been specifying a Fire, Water, Weather and Mildew Resistant (FWWMR) finish on heavy cotton ducks for a number of years but this had rarely been applied to the lighter materials used in camping tents, awnings etc. It is a general precept that, using cellulosic materials (usually 100% cotton) the heavier the fabric the more easy it is to make it flame-resistant. Wax-emulsion finishes were largely used.

4.4.3 It is generally known that there is a loss in tensile and tear values of up to 20% caused by the application of the wax emulsion FWWMR finishes on those lightweight cotton fabrics which had become industry standards, and the development of stronger base fabrics was necessary. The polyester/cotton blends provided greater strength without an increase in weight and these fabrics were then given the suitable

4.0 FINDINGS (cont'd)

4.4.3 "three-way"[1] finishes. The residual tensile and tear values after finishing were equal to or better than the previous cotton fabrics.

4.4.4 This developmental work required time and it had a decided impact on implementation of the regulation. As a result, although the enactment of regulation in Michigan on May 11 1972 called for immediate implementation, the industry was not ready to produce to meet the standard and on 11 October 1972 the implementation date was changed to 1 April 1973. Finally on 27 May 1973 the date was once again amended to 1 October 1975 and even then industry had not perfected the fabric/finish combination, but it was able to meet the standards. A total of 3½ years was required to make the transition. Regulations introduced by other states were able to take advantage of industrial progress and impose shorter implementation times.

4.4.5 The situation in the United Kingdom is substantially different. There was no legal requirement to introduce flame-resistance so far as camping tents were concerned and the industry generally did not take voluntary action. In other words, there was no pressure to carry out technical innovation. Discussions with British industry indicated that, in the absence of such pressure, the tent manufacturers did not wish to move to a higher priced product by

Note: (1) The term "three-way" is sometimes applied when properties of flame-resistance, water-resistance and rot-resistance are applied to a fabric.

4.0 FINDINGS (cont'd)

4.4.5 adding FR properties. A very large part of the market has been lost to imports and the British textile manufacturers and proofers are now looking for business to compensate for the loss of domestic sales. They are beginning to consider polyester/cotton blends as suitable substrates. Failure to innovate and loss of market may be coincidental but the two facts are undisputed.

4.4.6 There has been a dramatic change in the use of 100% cotton fabrics and polyester/cotton materials in tentage in the United States. In 1972, when regulation was first introduced, cotton was the major fabric for camping tents and the use of polyester/cotton was negligible. The specific consumption figures are not available. The situation 10 years later had completely reversed the ratio, polyester/cotton usage being almost 10 times that of cotton. Polyester/cotton tentage fabrics used by the US industry in 1982 was 5.7 million square yards. During the same year, only 0.6 million square yards of 100% cotton fabrics were used by the industry.

4.4.7 Canada is currently in a similar situation to that in Michigan in 1972. Until very recently the Canadian textile and proofing industries have not departed from the traditional water and rot-resistant treatments on 100% cotton fabrics for the tent industry. So long as there was no market demand or legal requirement for flame-resistant tentage with its higher cost, the industry stayed with water and rot-resistance in order to be competitive within an existing price-structure. The tent manufacturing industry is notoriously price sensitive, partly because the retail market is more utility-conscious then luxury-conscious.

4.0 FINDINGS (cont'd)

4.4.8 It is the tent manufacturers, importers and their retailer customers who would primarily be charged with compliance with the regulation but they are totally dependent upon the material suppliers. So far as the imports are concerned it would appear that coated nylon fabrics can be manufactured which would meet CPAI-84, indeed the foreign manufacturers claim to be meeting the standard in their trade with USA.

4.4.9 The Canadian nylon tent market, which has increased significantly in the past 10 years at the expense of other materials such as cotton, utilizes a light weight filament nylon fabric, coated with polyurethane or other suitable compound, often treated with silicone or fluorocarbons on the uncoated side. Water-and rot-resistance is being achieved, but flame-resistance is not normally incorporated. Some imported tents are flame-resistant but this is often fortuitous. They are not purchased and retailed as FR tents, but often the items delivered by foreign suppliers are from production runs intended for USA and the items are flame-resistant.

4.4.10 So far as domestic production of coated nylon fabric is concerned, Consoltex Inc. has developed a number of fabric styles all of which meet CPAI-84 and all have the physical and chemical properties required for their use in tentage. The company has willingly provided samples and test results. The company should be commended for its timely innovation in the nylon material market. A major Canadian manufacturer of nylon tents states that the company utilizes a coated nylon fabric which meets the requirements of CPAI-84.

4.0 FINDINGS (cont'd)

4.4.11 The situation with regard to imports of 100% cotton and polyester/cotton tents is less clear. During the course of the study, there were no reports of evaluation of imported tents made from materials which had been treated for FR. Despite this it has been established that the technology exists, especially in the United States and Europe, and the possibility of increased imports is very real unless Canadian industry is given time to make technical and production line changes. Some of the non-Canadian industrial contacts have already started the development process with the object of selling water, rot and flame resistant camping tent materials on the Canadian market. Samples of their heavier materials have been obtained as proof of their capability.

4.4.12 Recent Anti-Dumping Tribunal hearings concerning imports from East Germany, Czechoslovakia and China clearly illustrate the concern of Canadian industry and aggressive marketing by other countries. International trade is a fact of economic life, and importers also make a contribution to the Canadian economy, but it is important that federal regulatory action is not instrumental in the domestic industry losing its share of the market.

4.0 FINDINGS (cont'd)

4.4.13 It might be argued that all Canada has to do is to duplicate US or UK technology. This is not so. The structure of the Canadian textile industry is peculiar to itself. For instance the production of fine yarns from combed cotton is extremely limited compared to that in USA. There are differences in the range of equipment used and Canadian experience and expertise in the technology of flame-retardancy is not well developed so far as tentage materials are concerned. Foreign firms contacted during the course of the study were reluctant to engage in technology transfer and thus the acquisition of constructions and formulae is a dubious proposition. Canada has to plot her own course to suit her own industry.

4.4.14 The application of many of the commercial finishes can result in range of objectionable fabric "hand"(1) and surface characteristics ranging from a wet feeling, tacky surface to a dry but overly stiff "hand". If the Canadian proofing industry has to make a product change, it should aim for a finish which is likely to remain acceptable and marketable for the future. This would be a water, rot and flame-resistant treatment which has a dry "hand", a minimum add-on of weight, minimum loss of tear and tensile values, be as flexible as possible and not unduly limit coloration. To this must be added the minimum increase in cost requirement.

Note (1): "Hand" or "handle" describes the feel of the material and qualitatively includes such terms as stiff, limp, hard, soft, rough, smooth. The terms 'dry' and 'wet' used in this context not only refer to 'hand' but to appearance. A tacky hand, which can be found in both a dry and a wet finish is one which is sticky to the touch.

4.0 FINDINGS (cont'd)

4.4.15 The fabric proofers, upon whom the success of conversion to FR depends, are developing FWWMR finishes for tentage. Toronto Dyeing and Finishing Ltd. and Scythes Inc. are working on a suitable finish on substrates yet to be determined. Walter Clegg Associates Ltd. has shown that the company is able to apply a dry FR finish to cottons and blends but it is understood that they have not yet applied a water, rot and flame-resistant to fabrics specifically designed for camping tentage. Dominion Textile Inc. is developing a fabric/finish combination and is aiming for marketing the product in mid-1985, however the company has declined to provide information on the base fabric, the type of finish it will use, the physical properties, the cost increase or whether or not the material will be produced and finished within the company's manufacturing facilities. The company will deal directly with its customers when the product has been developed but it is unwilling to disclose the information to the Department or to ADGA.

4.4.16 Of the finishes which have been applied to tentage fabrics there are three which appear to be frequently used in the European and North American industries. They are:

4.0 FINDINGS (cont'd)

a. Antimony oxide with chlorine-containing compounds, usually in the form of chlorinated waxes and polyvinyl chloride emulsion, with the additions of suitable rot-inhibitors. This is often referred to as a wax-emulsion finish. It is by far the most widely used finish applied to tentage fabrics and in UK and USA a dry (non-tacky) finish has been successfully developed.

b. Tetrakis hydroxymethyl phosphonium chloride (THPC) such as the propriety product of Albright and Wilson Ltd., England marketed as "Proban". It is compatible with selected water-repellants and rot-inhibitors. It is a cured finish (ammonia vapour) and it is not "tacky".

c. Organic phosphorus compounds such as Pyrovatex CP (CIBA-GEIGY) which are compatible with selected water-repellants and rot inhibitors and which also produce a dry finish which is heat/time cured.

It has not been possible to examine all flame-retardant chemicals within the time-frame but the above compounds are those which have been discussed during the study. Each of the three compounds results in a significant add-on of solids (up to 40% in the case of some wax-emulsion finishes) and a loss of tear strength values up to 20%. There is more recent laboratory data which indicates that the loss of tear and tensile values can be less than 12% with some tests achieving zero loss.

4.0 FINDINGS (cont'd)

4.4.17 A project to develop suitable tent materials for FR finishes should include an evaluation and test phase. When the object of the regulation is to provide a greater degree of protection of human life and safety it would be unwise and certainly risky to supply the market with tents made from unproven materials. In addition, the tent manufacturers could experience problems when sewing and in the handling of the goods. The industry would be required to use, not merely new finishes, but in all probability a series of new base fabrics or substrates to carry those finishes. The variables are many and the industry should not be stampeded into premature acceptance of new fabric/finish combinations.

4.4.18 In addition there is the problem of equipment. The wax-emulsion treatment can be applied using existing drying ranges but there is no guarantee that these finishes would meet the requirements of CPAI-84. Two leading cured finishes are Proban and Pyrovatex. The first uses an ammonia vapour cure while the second employs a heat/time cure. One company, Walter Clegg Associates Ltd. is currently equipped to apply a cured finish but other proofers would possibly require a suitable curing range. Existing drying ranges may provide the requisite time and heat control but as equipment differs from plant to plant, each case must be examined on its own merit. A heat/time stenter curing range is available from a number of machinery manufacturers while the ammonia vapour equipment can be supplied for £12,000 ($21,000) plus freight, customs, taxes and installation, from Albright and Wilson Ltd., the company which holds the rights to Proban. It is considered that each plant would only require one curing range at the outset.

4.0 FINDINGS (cont'd)

Both types of installation would require an effective vapour exhaust system with the necessary filtering to meet local emission requirements. In some cases the existing system may be adequate but each production facility would have to be checked on its own merits. Because of this fact it is not possible to translate capital equipment costs into a price increase factor on the product, but obviously it would have to be included by each company according to their costs.

4.4.19 The tent manufacturers will require an efficient dust control and exhaust system to protect the health of their workers. Appendices M and N are the standard documents issued by Albright and Wilson Ltd., who produce the chemicals for Proban, and by J.T. Inglis and Sons Ltd. one of the largest proofers in UK. Their statements with regard to occupational health are made as the result of extensive tests and studies conducted by Government and independent laboratories. There is no apparent danger to health in handling the finished goods provided that a high standard of personal hygiene is maintained and dust control is employed. Again it is not possible to arrive at a universal cost factor as it varies from company to company.

4.0 FINDINGS (cont'd)

4.4.20 Military Requirements The Department of National Defence specifies a polyester/cotton core-spun fabric with a water, rot and flame-resistant dry finish. Approximately 100,000 m of this fabric is used each year in modular tents and other items. The fabric was introduced a number of years ago in order to reduce the weight and bulk of the previously-used cotton ducks and to incorporate the three-way finish. Unfortunately the Canadian textile industry declined to produce the core-spun base fabric and the Canadian proofers could not apply the finish, consequently the material has been imported from Britain for years. If the development of new industry standards for fabric/finish is successful, Canadian industry would be in a better position to produce a suitable tentage fabric which could replace the imported core-spun cloth. At the very least, they could finish the cloth in Canada.

4.4.21 Another approach to achieving flame-resistance is the utilization of fibres which are inherently flame-resistant. A number of fibres are on the market which possesses this property and they are being used in industrial and protective clothing fabrics. The only application of these fibres to tentage materials has been carried out by the military research and development organizations. Bearing in mind that no fibre possess all properties to meet all requirements, development programs will have to be carried out to design suitable tentage materials. FR fibres are available in a variety of tenacities and with varying properties and prices.

4.0 FINDINGS (cont'd)

4.4.21 Provided that they are competitive in price, inherently flame-resistant tentage fabrics would have durable FR properties, a more simple finishing process, minimal loss of tensile properties, more flexibility and lower weight and bulk. This approach is one which could be developed for the future.

4.4.22 There would appear to be four areas which would merit the attention of industry. They are:

Tent Manufacturers:

1. The major manufacturers, either individually or collectively, should determine their technical requirements for the new range of FR tent materials and, in conjunction with industry and/or technical consultants, carry out a program of development and evaluation. The results of this program would determine the new industry standards which would replace the existing cotton fabrics. Different fibre blends, fabric construction and finishes should be considered and experimented with in order to determine the series of materials produced in Canada which will meet the requirements at a marketable price. The proposed standards should govern performance for FR and the other materials requirements should be related to those performance levels of cotton materials which have given proven service in the past. The Shirley Institute, the renowned textile research and development agency, would be able to support such a program and there are undoubtedly other sources of research and development capability.

4.0 FINDINGS (cont'd)

2. The previously mentioned dust control and exhaust systems would have to be installed, if they do not now exist. Some hygiene and health education will be necessary to ensure that the operator is not contributing to his/her ill health. This is not a new departure and is standard procedure in a large number of industries.

Proofers

3. Some proofers may require new curing equipment and fume exhaust systems in order to produce materials which will meet the requirements of the proposed federal regulation, particularly if Proban, Pyrovatex and similar finishes are processed. Local emission control standards would also have to be met. As most proofers are already in production on wax-emulsion type finishes, their existing equipment should suffice for that type of proofing but it has yet to be demonstrated that a wax-emulsion finish on a polyester/cotton base will meet the proposed standard.

b. It is possible that some proofers may wish to consider the benefits of plant modernization if they decide to use new processes and install curing ranges.

4.0 FINDINGS (cont'd)

4. The technology of flame-resistant finishes may not be available within a number of companies. There could therefore be a requirement to import technology from a number of sources including textile research agencies, FR chemical producers, established proofers in other countries or through a technical consultant who could utilize all sources. There could be scope for joint action with the tent manufacturers on an individual or collective basis.

4.4.21 Recommendation

It is recommended that the courses of action outlined above be considered for implementation by industry as soon as possible.

4.0 FINDINGS (cont'd)

4.5 FINANCIAL ASSISTANCE

4.5.1 There are a number of federal and provincial government program which are directed towards providing financial assistance to companies or groups of companies for various purposes. The two federal programs whose terms of reference cover the requirements of the tent manufacturers and the proofers are Sector Firms Programs (Textile, Clothing and Footwear) of the Canadian Industrial Renewal Board (CIRB) and the Industrial and Regional Development Program (IRDP) administered by the Department of Regional Industrial Expansion. Discussions have been held with officers in both agencies. The role of provincial government programs must not be overlooked, although these could not be examined in this study.

CIRB

4.5.2 The agency representative emphasized that CIRB is not in being to prop up or prolong dying companies but it will consider the provision of assistance to selected companies for revitalizing, restructuring if necessary and plant modernization. The Board is also most interested in any proposals for the establishment of common services. In the context of the tent flammability program common services which may be considered are test and evaluation facilities, material applications, data gathering and analysis, technical support, coordinated purchasing of materials, etc.

4.0 FINDINGS (cont'd)

Up to 75% of consulting costs for feasibility studies, analysis of operations and planning can be granted to successful applicants. Up to 50% of capital costs can be approved for renovation or installation of new equipment. This is but an outline of the assistance available through CIRB. For those industrial concerns which are seriously considering making application, more detailed information is available. The program is scheduled to end in 1986.

IRDP

4.5.3 This program can provide financial assistance to companies through grants, contributions, repayable contributions, participation loans and loan guarantees. It is regionally oriented in that the maximum sharing ratios are graduated into four tiers according to the need of the area. The amount and support offered is based upon the nature of the project, the need for program support, the value attained from the money and the economic objectives of the government of the day. The maximum sharing ratios normally range from 50% to 75% according to tier, although funding for new plant establishment and for acquisition of equipment for modernization purposes can be at a lower level.

It would appear that some materials development work identified earlier, as required by the proofers and the tent manufacturers could be considered under the IRDP program under the following headings:

4.0 FINDINGS (cont'd)

4.5.3 (cont'd)

Innovation

- Consultant studies on project feasibility, etc.
- Developing new products or process;
- Developing technological capability;
- Design

Modernization

- Consultant studies on project feasibility, etc
- Modernization of equipment

4.5.4 A summary of the program is attached as Appendix 0. Once the industrial and the retail sectors have adjusted to domestic manufacturing and sales of flame-retardant tents, other programs can be considered such as expansion into the export market and the development of new materials and structures.

4.5.5 Recommendation

It is recommended that, if industry requires financial assistance to make the technical and equipment changes necessary to meet new flame-retardant standard, it considers the CIRB and the IRDP programs and also relevant provincial programs. For some requirements it might be advantageous to act collectively.

4.0 FINDINGS (cont'd)

4.6 COST INCREASES AND THE ANTICIPATE EFFECT ON THE MARKET AND EMPLOYMENT LEVELS

4.6.1 The addition of flame-retardance to the properties of tent materials using the present state of technology will invariably result in an increase in cost of the materials and this will be reflected in the manufacturing and retail costs of the tents. Many Canadian tent manufacturers hold a somewhat pessimistic view on the effect of increased prices on the market, with some manufacturers forecasting the demise of the industry. However it must be remembered that these opinions were voiced without benefit of the additional information this study might provide. They have also exhibited apprehension regarding the sequence of events which has taken place on this matter. Finally the industry has voiced its anxiety and resistance in the light of the proposed 1986 implementation date for FR tentage.

4.6.2 The major retailers are also apprehensive but their long-range outlook is more bright. They can see an initial drop in sales during the first year of mandatory regulation because of consumer resistance to higher prices. Recovery would take place over the following two years because the demand for tents would have to be satisfied with FR items and no other items of lower protective values and price would be available. There might possibly be a faster recovery period with higher than normal sales to compensate for the first year's loss of market.

4.0 FINDINGS (cont'd)

4.6.2 (cont'd)

This is illustrated in Figure A. No values have been included as it is impossible to arrive at quantitative sales forecasts and price increases with any degree of precision.

4.6.3 Cost increases will vary according to the materials and finishes employed, size and design of the tent, source of materials, freight and customs duty where applicable and other factors. Cost data was obtained from a number of sources in three countries but comparison is difficult. The units of measurement vary as do the monetary units. In addition not all sources were willing to disclose their full costing and expressed cost increases in different ways. Costings are very sensitive issues and we have to attempt to utilize what was offered in the form in which it was offered.

The following raw data was obtained:

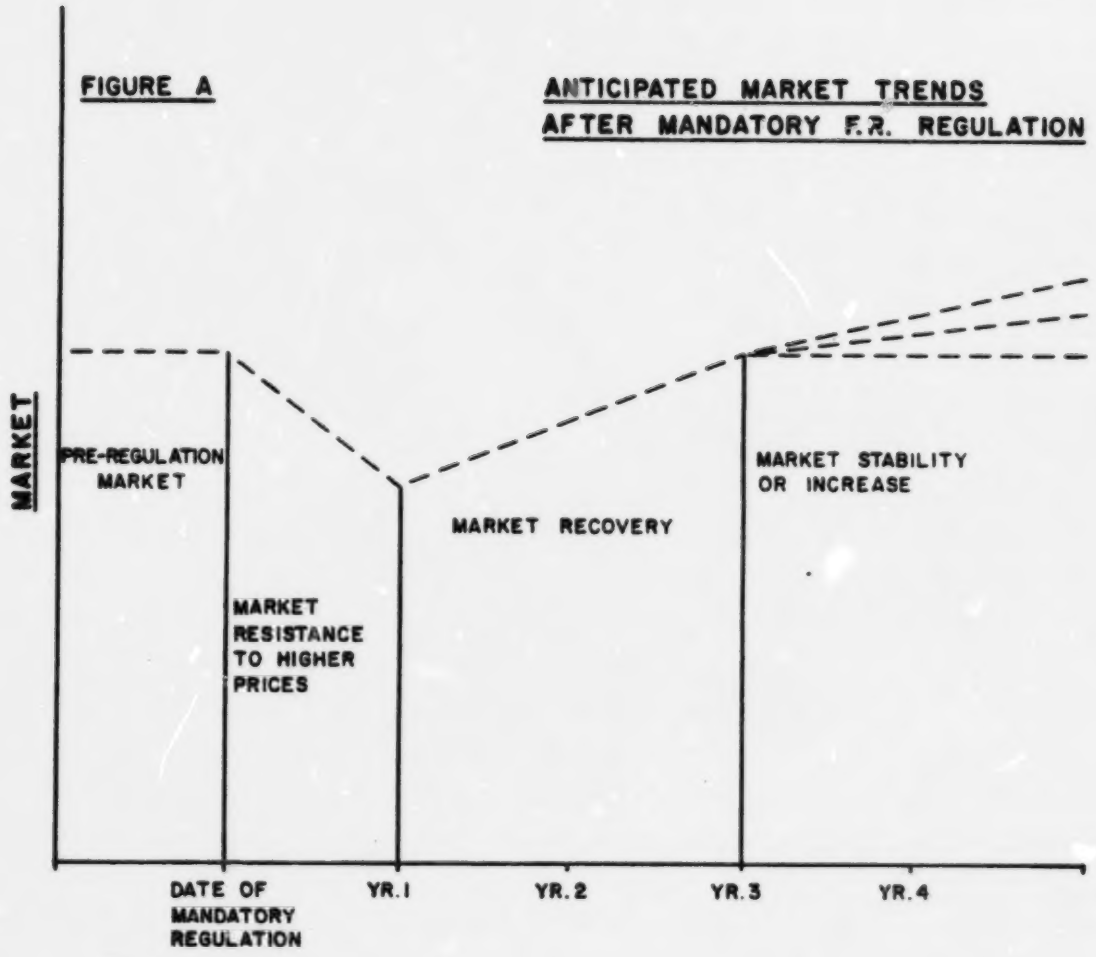
4.6.4 Nylon Tents

4.6.4.1 Materials

Canadian Manufacturer (Consoltex Inc)
Additional cost of FR treatment
$0.25 to $0.30/m (150 cm wide)

FIGURE A

ANTICIPATED MARKET TRENDS
AFTER MANDATORY F.R. REGULATION



4.0 FINDINGS (cont'd)

4.6.4.2 Tents

Imported from Far East

Example: 9 ft x 7 ft x 5 ft 6 ins x 18 ins with fly, poles, etc. f.o.b. country of origin

Non-FR	U.S. $41.80
FR	U.S. $43.80 (1)

Price increases for FR on imported nylon tents ranged from 3.8% to 6.8%, according to design and size.

On a tent and fly similar to the above example which uses a nominal 30 m. of cloth, the materials increase using the Canadian product would be C$7.50. The US$2.00 increase shown in the example could be as high as C$4.00 landed price after currency conversion, freight, customs and insurance costs have been included.

4.6.5 At first glance, it would appear that the domestic industry cannot match the imported price increases for the FR product, but there is no guarantee that we are comparing similar materials. The Canadian materials are all closely woven materials of good quality and construction. There is no available technical analysis of the materials in the imported tents to make a valid comparison.

Note(1): Subsequent to this information, the same retail source has indicated that they will be selling imported FR nylon tents in the 1985 season, at no increase in cost over non-FR.

4.0 FINDINGS (cont'd)

4.6.6 Canvas Tents

4.6.6.1 Materials

United Kingdom

1. A leading British Proofer

Increase in cost for FR over water-and rot-resistant cotton (Dry wax-emulsion finish) £0.22/m (C$0.38/m) This is a 22% increase in cost; the estimate was applied to a base fabric costing £1.00/m.

2. Another British Proofer

Increase in cost for FWWMR over cotton greige goods (Wax emulsion finish, not as dry as other example) £0.45/m (C$0.77/m)

These two figures are not comparable as the first applies to the additional cost of adding FR to a cotton fabric treated for water and rot resistance. The second estimate is for the application of water, rot and flame resistance to cotton greige goods.

3. Proban Cost of dry finish (Water, rot and flame-resistant) £1.00/yd² (C$1.72/yd² or (C$2.06/m²)

Cost increase for Proban only £0.60/yd² (C$1.03/yd² or C$1.23/m²)

4.0 FINDINGS (cont'd)

4.6.6.2 USA

1. A leading US proofer:
   Cost of wax-emulsion, water, rot and flame-resistant dry finish, to CPAI-84 US$0.65/yd² f.o.b. USA (C$1.01/m²)

2. Large proofer and tent manufacturer
   Cost of water, rot and flame-resistant, wax-emulsion finish US $0.60 to $0.90/yd² f.o.b. USA (C$0.93 to $1.40/m²
   Additional for dry finish (cured) US $0.14/yd² f.o.b. USA (C$0.22/m²)

4.6.6.3 This manufacturer also supplied the following data:

Fibre	Width	Greige Weight	Finished Weight	Price of Finished Fabric at US Plant
50% Polyester/50% Cotton Wax-based wet finish to CPAI-84 (FWWMR)	47" (120 cm)	4.7 oz/yd²	9.0 oz/yd²	US $1.65/yd (C $2.14/yd)
50% Polyester/50% Cotton Wax/based, oven-cured dry finish to CPAI-84 (FWWMR)	47" (120 cm)	4.7 oz/yd²	6.5 oz/yd²	US $1.95/yd (C $2.54/yd)
100% Cotton Wax-based, cured, dry finish to CPAI-84 (FWWMR)	47" (120 cm)	7.0 oz/yd²	11.3 oz/yd²	US $2.15/yd (C $2.80/yd)

4.0 FINDINGS (cont'd)

4.6.6.4 Canada

1. A large proofer of tentage materials
   Water and rot resistant only C$0.28-0.30¢/m. (Wax-emulsion finish)
   Water, Rot and Flame-Resistant C$0.40-0.50¢/m. (Rough estimate only)

2. Another large proofer, using the Proban, cured, dry finish
   Flame-resistant only C$1.00/m. and up.

4.6.6.5 Examination of this raw data indicates that the estimates of Canadian proofers can be competitive, particularly when freight, insurance and customs costs are added to the US prices. However only US production has been proven to meet CPAI-84 at this point in time. The British and Canadian estimates would probably have to be adjusted once they have completed development.

4.0 FINDINGS (cont'd)

4.6.6.6. Canvas Tents

Returning to the US data the treated cotton fabric price is C$2.80/yd². If we deduct C$0.93/yd² for the water, rot and flame-resistant finish on a 7 oz/yd² fabric, we can estimate the greige goods to cost C$1.87 yd². (This is close to the price of a Canadian produced cotton duck, quoted to Manta Industries at C$1.91/m².) The percentage increase for the application of the three-way finish is therefore 50%. The greige goods cost of the 7.0 oz/yd² polyester/cotton fabric is not known and, in any event the add-on of solids in the finishing process (i.e. the quantity of FR chemicals required) would be different to that of the cotton fabric. A similar calculation to that made for a cotton fabric cannot be made from the available data. This simple calculation produces an estimate based upon the data at hand. It would be more simple and accurate if the actual greige goods costs for all base fabrics were available, however many of these are dependent upon the results of development.

4.6.6.7 For the purpose of this study we can assume that Canadian production costs will be comparable and we can use a 50% increase figure for adding a three-way finish to cotton tentage of a weight used in camping tents.

4.0 FINDINGS (cont'd)

4.6.6.8 Manta Industries enjoys a sizeable market in prospectors' tents which use an untreated cotton duck. The company was most cooperative in releasing the manufacturing costs for the canvas portion of the tent. Other costs were calculated using an imported US duck of lower quality, but with a water, rot and flame-resistant finish which meets CPAI-84. At that time more comprehensive US data was not available, however a further calculation has been made using that data. This type of tent is not the normal camping tent and the use of untreated duck is peculiar to this product. However, the cost effect of adding FR properties is a serious consideration for this company. In addition, the citing of this example permits a useful comparison of costs to be made.

4.0 FINDINGS (cont'd)

Tent. 10 ft x 12 ft x 3 ft walls (32 m of cloth per tent)

	Manufacturing Costs(Canvas)
(a) Using Canadian greige 10 oz. cotton duck (Grade A)	$119.38
(b) Using imported 10 oz. cotton duck treated water, rot and flame-retardance	$168.34
(c) Using Canadian greige fabric with 50% cost increase to apply water, rot and flame-resistance	$150.10

This example shows that the manufacturing cost increase for the addition of water, rot, and flame resistance using imported US fabrics could be 41%, but if the Canadian textile and proofing industries complete their development the increase could be in the area of 26%.

4.6.6.9 These percentages are calculated at the manufacturing levels. The cost increase to the consumer could be higher than 26% once profit margins and retail mark-up have been added. In any event even a 26% increase in the cost of the product is substantial and could adversely affect the sales of the products particularly in the early years. It is re-emphasized that the 26% figure represents the cost of adding water, rot and flame-resistant finish to an untreated cloth. The cost of adding FR only would be lower.

4.0 FINDINGS (cont'd)

4.6.6.10 The increase in the cost of incorporating FR in camping tents which are normally treated for water and rot-resistance only has been suggested to be in the range 12% to 20% by a number of sources. This is still a significant increase which could have an initial impact on sales. If the material was imported from USA, Manta has calculated the manufacturing costs of the 10ft x 12 ft tent with water and rot resistance only to be $143.25, an increase of 20% over their untreated tent. The addition of FR (see 4.5.6.8) results in a cost estimate of $168.34 for this tent, which is 17.5% over the cost of water and rot resistance only and within the 12-20% range quoted. As the cost of distribution and the retail mark-up varies across the industry, the increase in cost to the consumer cannot be given. However as the manufacturing cost increase is expressed as a percentage (12-20%), the increase to the consumer may well be in the same range when expressed as a percentage of the retail price for non-FR tents.

4.6.6.11 One solution to the special market for prospectors' tents is to consider the use of an FR finish only. The current market appears to survive without the provision of water and rot resistance. The FR tent would be no less water and

4.0 FINDINGS (cont'd)

4.6.6.11 rot resistant than the current item and could be an acceptable product. This approach has not been discussed with the industry nor has it been costed.

4.6.6.12 The potential benefits to be derived from the promotion of the protection offered by the FR tents was discussed with some of the manufacturers and retailers. Any such benefits are intangible at this stage. In any event the consensus was that benefits obtained from a promotional program would be more than offset by the adverse effect of the price increase. However, it is considered that the promotion of FR tents by the government, industry and retail sector should proceed. Suitable information programs emphasing the added benefits of FR resistance could provide safeguards against market losses greater than those outlined in Figure A.

4.5.7 In addition there are hidden costs which are:

- Additional processing costs because of slow production of FR finishing. (Kellwood (USA) estimated this to be 2¢/yd.)
- The finished fabric is likely to result in slower sewing speeds and this would increase the production costs (This applies particularly to wax emulsion finishes which have a high add-on of solids.)

4.0 FINDINGS (cont'd)

- The finished product can be heavier and more bulky thus increasing handling and shipping costs.
- Testing costs.
- Amortization of capital equipment costs including ventilation and filter systems.

These increases are but a small part of the total cost increase, the major part of which is attributable to the cost of the FR materials. There is a possibility that some of the increased cost may be offset if polyester/cotton base fabrics can give equal or better performance than the cotton fabrics they replace, at lower cost. This cannot be determined until the development work has been completed. The US data is not available to us from industrial sources.

4.6.8 As previously stated, each source which has offered cost data has treated it differently. There is no standard unit of measurement and the costs are given in different currencies. There is little to be gained in attempting to arrive at comparative common values. In summary there is sufficient evidence however to indicate that increases of between 12% and 20% for the addition of FR will result in an initial adverse impact on the market for canvas camping tents and similar items. Although one major retailer has indicated that his sale price for imported FR nylon tents in 1985 would be the same as non-FR, other information indicates that this is not necessarily an industry-wide trend. Cost increase for FR in domestically produced nylon tents could fall into the 12-20% range of

4.0 FINDINGS (cont'd)

increase. The cost increase to the retail costumer could well be in the same range when expressed as a percentage of the previous retail price for a non-FR of similar size and design. There is reason to believe that the market will recover in succeeding years when the buying public realizes and accepts that non-FR tents are no longer available and that the FR tents offer a greater degree of protection for the additional cost.

4.6.9 Effect on Employment

It has not been possible to obtain industry-wide figures of the potential loss of employment if the implementation date of the regulation is too early to permit the necessary industrial adjustment. However some companies were able to provide well-considered estimates of loss of jobs under these circumstances.

Tent Manufacturers

(a)	Manta Industries Ltd Winnipeg, Man.	15 out of 50 employees working on all types of tentage
(b)	Ridgeline Products Inc. Toronto, Ont.	70 employees
(c)	134599 Canada Ltd Toronto, Ont.	Possibly all employees. Company could not remain in business

4.0 FINDINGS (cont'd)

4.6.9 Effect on Employment (cont'd)

Textile Manufacturers and Proofers

(d)	Toronto Dyeing & Finishing Ltd Toronto, Ont.	Possibly all employees as company could consider cessation of business
(e)	Consoltex Inc. Alexandria, Ont	10 - 14 employees (This company has already developed nylon fabrics which meet CPAI-84. The 10-14 employees cited could therefore represent a loss of potential employment.)
(f)	Dominion Textile Inc. Montreal and Eastern Townships, Eastern Ontario	None. The company is not dependent upon tent materials to maintain viability. It can compensate with its many other products.

Note: Full employment figures were not given by the companies so that expression of loss of employment as a percentage of the work force is not possible.

4.0 FINDINGS (cont'd)

4.6.10 This is merely an indication of the general trend and admittedly it represents the worst situation. If this trend was applied to the total tent industry and its suppliers the impact of loss of employment could be substantial. Although the data is not available to provide an accurate estimate, it is considered that, in the tent industry the loss of jobs could be as high as 500 across Canada, with up to 100 jobs being lost in the proofing industry. It is therefore very important that implementation timing of the regulation be well-considered and capable of being met by industry. Business generated by the market demand for military tents, marquees and large assembly tents is not sufficient to support the industry in its present structure and production potential.

4.6.11 Discussions with the industry indicate that, if adequate time is allowed for conversion to FR production, no permanent loss of employment is anticipated, particularly if measures are taken to temporarily protect the current share of the Canadian market enjoyed by the domestic industry, during the period between promulgation and implementation of the proposed regulations. (See para. 4.7.18)

4.0 FINDINGS (cont'd)

4.7 IMPLEMENTATION TIMING

4.7.1 The original implementation dates proposed by the Department of Consumer and Corporate Affairs were:

- the mandatory use of warning labels on all tents sold after 1 April 1985.
- by 1986 all tents manufactured and sold in Canada to be flame-resistant.

The industry and other interested parties were made aware of these dates as proposed deadlines prior to the Ministerial announcement of 5 June 1984 but the timing became official and public knowledge with the publication of that announcement.

4.7.2 The schedule for implementation attracted a great deal of resistance from the industrial representatives who attended the CCAC meetings in Ottawa. However the optimistic departmental timings were made without benefit of an in-depth study and the bleak picture painted by the industry in response was also made without benefit of a study or survey. The department stated that it had, attempted to obtain data and estimates from the industry prior to the study, but it reports that it had little success. Industry had also made requests for information particularly on tent fire statistics, but the data base had to be developed by the department over a period of time.

4.0 FINDINGS (cont'd)

4.7.3 Labelling

The general concensus of Canadian industrial contacts, importers and retailers is that, in general, the labelling requirement can be met. Some tent manufacturers have already prepared their labels for the 1985 season, however one or two companies would have preferred to have a 1 October 1985 implementation date. This would have given them, in effect, a further year breathing space because of the seasonal cycles in the industry. As it has been shown by a number of manufacturers that the 1 April, 1985 deadline can be met, the only case for the 1 October 1985 date is that the time to implement is growing shorter and the industry has already started manufacturing for the 1985 selling season. The retailers and importers who were contacted support this revised date.

4.7.4 Even though some manufacturers have anticipated the requirement, the regulation has not yet been promulgated and thus there is no legal requirement for the labels at this point in time. Other members of the industry who have not anticipated the requirement should not be penalized for not complying with a regulation which does not yet exist. As practically all tents are labelled at present, any increase in cost should be marginal as the principal change is in the message.

4.0 FINDINGS (cont'd)

4.7.5 Recommendation

It is recommended that the Department of Consumer and Corporate Affairs consider the implementation date for warning labels be changed to 1 October 1985. This would apply if the original promulgation date of the regulation does not permit sufficient time for adjustment in production for the 1985 retail season, either by sewing-on labels or by providing a pressure-sensitive label. (See para. 4.7.8)

4.7.6 Carry-Over of 1984 Stocks

While the previous recommendation pertains to tents now being manufactured for sale in 1985, another problem exists with the carry-over of stocks of tents from the 1984 season. The stocks may be at the manufacturers, wholesalers or at various locations in the retail distribution system and will have to be sold in the 1985 sales season. These tents may not carry warning labels in accordance with the proposed regulation. A number of solutions can be considered:

1. Provision be made by the regulation to exempt the 1984 season carry-over from the labelling requirement. The Department is reluctant to adopt this course if there is a feasible method of affixing the labels.

4.0 FINDINGS (cont'd)

4.7.6 Carry-Over of 1984 Stocks (cont'd)

2. Unpack the tents, sew on labels and repack the tents. This is a costly approach estimated by Sears Canada Ltd to be $5.00 per tent. Furthermore department store chains have the additional cost caused by the distribution of the tents. For instance Canadian Tire Store has 375 franchised outlets. It would be a monumental task to call in stocks to central warehouses for relabelling and return them to the individual stores. The actual sewing of the labels is less than practical. When a tent is manufactured the label is sewn on a panel which is then incorporated into the tent. Sewing a label on a completed tent is not a simple proposition and location of the label would be limited. In addition, a repacked tent does not look like new merchandise and would be more difficult to sell. This approach is not recommended, but should not be excluded if a manufacturer, distributer or retailer wishes to use it.

3. Affix the warning label on the outside of the package. This would not provide a label on the tent itself where it would be of greatest use. For this reason it is not recommended.

4. Add a loose instruction sheet to the package. Again this does not provide a permanent and continuing reminder of the hazards. Not recommended.

4.0 FINDINGS (cont'd)

4.7.6 (cont'd)

5. At the sales point provide a pressure-sensitive warning label with an instruction to the customer to affix this to the tent when it is first unpacked. While this relies upon the action of the individual customer it should result in action by the majority and provide a continuing warning to the users of the tent. This is the recommended course of action.

4.7.7 In order to obtain an estimate of the magnitude of the re-labelling of carry-over stocks, the following examples are pertinent:

Dorcy-Ashflash Ltd. Importers	12,000 units
Sears Canada Ltd. Retailers	6,000 units plus those on the floor at stores

The predicted sales for 1984 by Sears is 33,000 tents. The carry-over of 6000 tents represents 18% of the total of 33,000. (The 33,000 would include carry-over from 1983 and thus the 33,000 figure could be regarded as the total market for the company for 1984.) If the 18% carry-over is applied to the 334,619 tents on the Canadian market for 1982 there would be a national carry-over of 60,230 which would need new labels.

4.0 FINDINGS (cont'd)

4.7.8 Recommendation

(a) It is recommended that re-labelling of the carry-over of 1984 stocks for sale in 1985 be accomplished by the use of durable pressure-sensitive warning labels issued at point of sale to individual customers, together with suitable instructions to stick the label to the tent on the inside. This approach could also be applied to 1984 production to meet the existing 1 April 1985 deadline, if a company has not already taken action to sew in labels.

(b) It is also recommended that the unpacking, stitching of labels, repacking method be permitted if a company wishes to use this approach.

4.7.9 Timing

The question of implementation timing acceptable to both industry and government is vital to the success of any regulatory action, the maintenance of a viable Canadian tent industry, the prevention of permanent loss of business and employment and the provision to the consumer of a safer product which has been fully evaluated and proven.

4.0 FINDINGS (cont'd)

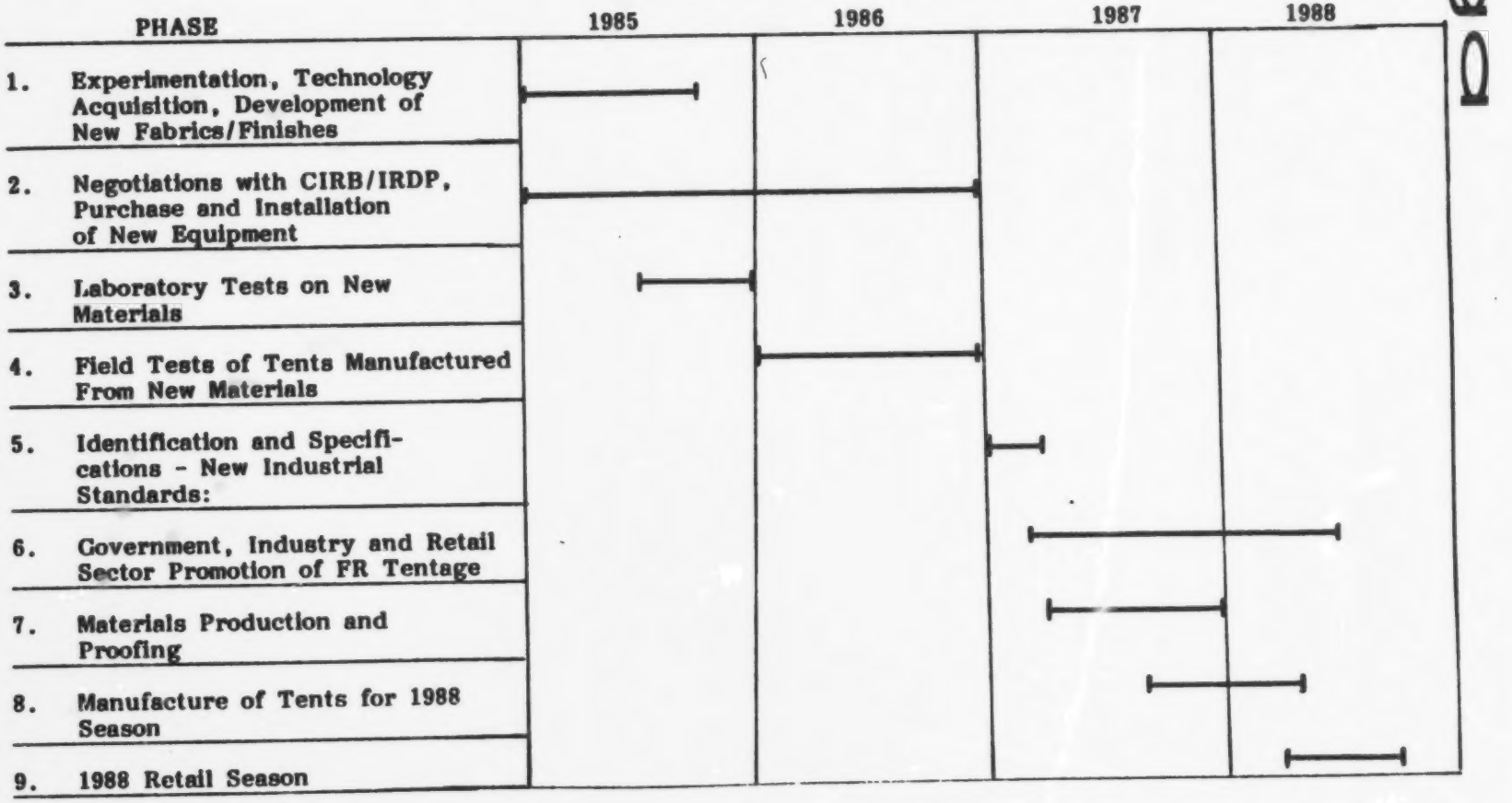
4.7.10 Let us examine the stages to be gone through before FR tentage can be offered to the consumer. The necessary time to complete each stage is based upon the experience of the consultant and that of the various industrial contacts. It is important to note that these timings represent the best situation i.e. all attempts are successful. No provision has been made for repeating stages, projects or processes.

Serial	Stage
1.	Proofers acquire technology and experiment with applying finishes on a new series of base fabrics.
2.	Identification of new equipment; obtaining financial assistance; acquisition and installation of new equipment.
3.	Laboratory tests on experimental fabrics/ finishes.
4.	Outdoor tests on tents.
5.	Identification of minimum standards for a new family of base fabrics and finishes.
6.	Preparation of promotion in government and retail sectors.
7.	Materials production for manufacturing season
8.	Manufacture and delivery of tents.
9.	Retail sales.

Many of these stages are carried out concurrently and the time factor is illustrated in Figure B. Serial 1 would normally take longer than depicted, but most proofers have already started their experimental work.

FIGURE "B"

IMPLEMENTATION TIMING - FLAME RESISTANT TENTAGE
MINIMUM TIME SPAN BY PHASES


PHASE
1985
1986
1987
1988
1. Experimentation, Technology Acquisition, Development of New Fabrics/Finishes
2. Negotiations with CIRB/IRDP, Purchase and Installation of New Equipment
3. Laboratory Tests on New Materials
4. Field Tests of Tents Manufactured From New Materials
5. Identification and Specifications - New Industrial Standards:
6. Government, Industry and Retail Sector Promotion of FR Tentage
7. Materials Production and Proofing
8. Manufacture of Tents for 1988 Season
9. 1988 Retail Season

ddgd

4.0 FINDINGS (cont'd)

4.7.11 The outdoor testing identified in Serial 4 might be arguable but it is considered that with the introduction of a new safety measure, the products should be given all possible evaluation. In any event, field testing is being carried out concurrently with the equipment phase (Serial 2) and therefore the total implementation time is not increased. Furthermore any condensing of time in Serials 2 and 4 is not going to change the implementation date of 1988.

4.7.12 Again it is emphasized that these dates represent the best possible situation. The time span from 1984 when experimental work started, is 3½ - 4 years. The tent manufacturers would favour a five-year program to give them more breathing space particularly as the process of introducing new products rarely runs smoothly, however the current experimental work by the materials industry may help to reduce the 5 year requirment. One prominent Canadian textile manufacturer favours retention of the 1986 date because the company expects to be able to meet it. However this is a statement of intent at this time as there was no evidence to indicate programs to date. Furthermore it is considered that it is not normally the intention of regulation to create a near-monopoly. The industry as a whole must be considered. (See Para. 4.3.15)

4.7.13 Utilizing 1988 instead of the announced 1986 as a target date there are a number of approaches to be taken in the light of the Ministerial announcement which reads:

4.0 FINDINGS (cont'd)

4.7.13 (cont'd)

"Although a flammability standard cannot be implemented in time for the 1985 camping season due to long lead times required for ordering materials, shipping and distribution, and the need for a transitional period to allow manufacturers to comply with the regulation, I expect the standard to be applied to those products marketed for the 1986 season."

4.7.14 The study has demonstrated that implementation before 1988 is not feasible. However the Minister did not refer to mandatory regulation by 1986. This leaves the way open to promulgation of a regulation in 1984/85 with an implementation date for mandatory regulation of 1988 or later.

4.7.15 There are two prime approaches to achieving this, both based upon a regulation to be promulgated in 1984/85. The first is to make the regulation voluntary in 1986 and mandatory in 1988. This supports the Ministerial announcement regarding application of a standard in 1986. The second approach is to publish the regulation in 1984/85 with a mandatory implementation date of 1988.

4.7.16 The effect of each approach on the various commercial sectors is almost identical. At one stage of the study I advanced the thought that there should be a 5 year period of voluntary regulation, followed by a review to determine if the voluntary approach should be continued or replaced by a mandatory provision. Since then evidence has been obtained that where voluntary FR measures have been introduced, the tendency is not to use them as industry standards.

4.0 FINDINGS (cont'd)

4.7.16 (cont'd)

Either of the two approaches outlined would identify the deadline and provide motivation to the industry together with adequate time to implement. The first approach has the additional advantage of identifying standards which should be met in the transitional period if an item is to be sold as flame-resistant. This would prevent the market being flooded with sub-standard FR material such as rejects from the US market. (See para 3.6 et al)

4.7.17 Recommendation

It is recommended that the regulation include provision for mandatory application of the FR requirements to meet the proposed standard, by the 1988 retail selling season, with the same standard to be applied on a voluntary basis in the interim period prior to the implementation deadline.

4.7.18 As there will be a transitional period to allow for industrial adjustment, it is considered that the Canadian industry will need some form of protection from loss of its markets during that period. It is therefore suggested that the Department of Consumer and Corporate Affairs investigate the various options with other federal agencies regarding protective measures which could be instituted to prevent loss of markets by Canadian industry until such time as the regulation is implemented. This protection could be in the form of temporary non-tariff barriers as it has been observed that tariff barriers could be difficult to implement and could require approximately 2½ years for the process.

4.0 FINDINGS (cont'd)

4.8 MONITORING

4.8.1 A regulation, be it mandatory or voluntary, is virtually useless unless there are adequate means of ensuring that it is being complied with. The consumers must be protected because they are buying in the belief that the product meets an accepted flammability standard. The tent-manufacturers and retailers are the sectors which are charged with the responsibility but each is dependent upon its suppliers to meet the standard. Neither sector can do much to contribute to compliance except to subject their supplies to laboratory testing on a random selection basis, using the proposed standard as a level of acceptance.

4.8.2 The real responsibility rests with those who manufacture the materials and it is assumed that the Canadian textile manufacturers and finishers have an adequate internal quality control program which tests samples from all production runs and batches. Records should be maintained of all test results so that a data base is established in case of future claims or problems. If a manufacturer does not have the in-house test facilities, independent testing establishments, Ontario Research Foundation and Underwriters' Laboratories Inc. in particular, have the capability. The manufacturers should normally issue certificates of compliance for the runs of goods shipped to the tent manufacturer. It is considered that, in the interest of prevention of injury and death, the regulations, when implemented should be adequately enforced by the Department to ensure

4.0 FINDINGS (cont'd)

4.8.2 (cont'd)

that tents manufactured, imported, advertised and sold in Canada do in fact meet the standard. It is acknowledged that the Department has enforcement programs, but this industry needs to be assured that compliance will be effectively controlled. In the case of imports there is little or no Canadian-based control over the product until it has been shipped to Canada and, for the protection of the importer, retailer and consumer, monitoring by testing the items to the standard is all the more important.

4.8.3 Each Canadian manufacturer, importer and retailer not only needs to be assured that his product consistently meets the regulation, he needs to know that his competition is also meeting the standards on a continuing basis. Adequate monitoring and enforcement is a fair and effective means of ensuring compliance with the regulation, provided that enforcement of the regulation is supported by the application of sanctions.

5.0 MISCELLANEOUS OBSERVATIONS

5.1 Experience gained in the course of this study has indicated that, as more information became available to the parties involved in this regulatory action, opinions which had previously been forcefully expressed become more tempered and even changed entirely. In addition, there are some issues which have been identified which are either beyond the terms of reference of this study or which do not warrant the full weight of a recommendation. Nonetheless they are worthly of further examination by the responsible parties. These issues are identified as observations.

5.2 No matter what industrial area is proposed for regulation it is essential that all technical and economic problem areas be identified and that relevant information is disclosed and discussed by all parties. Information uncovered by this study would have eased negotiations had it been available prior to the recent round of meetings. It is also essential that industry in general constantly up-dates its technology and equipment and thus is not required to make, within a very short period of time, those advances which could have been made in preceding years.

5.0 MISCELLANEOUS OBSERVATIONS (cont'd)

5.3 With particular regard to the tent flammability situation, there was an opportunity to view on film a series of controlled tests in the United Kingdom and the United States involving the burning of tents. Some tests involved tents which contained camp beds and sleeping bags. It was very apparent that these items were ignited by the original ignition source or by flaming debris and they continued to burn long after the tent had been consumed by flame. Quite often sleeping bags and beds are used in the open close to camp-fires and thus do not need a burning tent to ignite them.

5.4 In order to support future regulatory and other action in any product area, the need for a centralized data-gathering system which can provide Canada-wide statistics on the hazard in question might be examined.

5.5 There is a need for industry to continually adapt to new technology. In the case of the textile industry the proofers and the tent manufacturers, it is suggested that product and process improvement be continuously followed and that for the future, the use of inherently flame-retardant materials be investigated. The financial cost of technical improvement and development could possibly be partly covered by one of the many federal and provincial financial assistance programs.

6.0 CONCLUSIONS

6.1 There is evidence to show that death and injuries from tent fires are not limited to burns but can also be attributed to excessive exposure to heat. Other related hazards could cause incapacitation but are not likely to be fatal.

6.2 If flame-resistance of camping tents and similar shelters is to be regulated on a national basis, mandatory regulation appears to be the approach which is likely to achieve success.

6.3 Canadian industry has the potential to process water, rot and flame-resistant finishes but a great deal of experimental and development work is needed before they can be used in the construction of tents. The situation is further complicated by the fact that new textile substrates will probably be necessary. The traditional cotton fabrics usually suffer a significant loss of tear and tensile strength after having been given a water, rot and flame-resistant treatment. The mass of the cotton fabric can be increased to compensate for this but it would result in a much heavier and bulky tent. It is probable that polyester/cotton substrates will have to be employed.

6.4 There is little danger in the area of occupational health caused by the use of FR chemicals and finishes, provided that adequate fume exhaust and dust control measures and personal hygiene standards are instituted and maintained.

6.5 In most cases technology would have to be acquired and this will also entail new equipment and processes, depending upon the system adopted by each proofer. If federal or provincial financial aid is necessary to effect the changes, time for negotiation, purchase, installation and pilot production is necessary.

6.0 CONCLUSIONS (cont'd)

6.6 Other phases include laboratory and field testing, identifying new industry standards, and production start-up in the textile and the tent manufacturing industries. The time necessary to carry out all phases in a logical sequence is at least 3½ years and the regulation could not be implemented until the 1988 selling season. This applies to the actual FR requirement. The labelling requirement will cause few problems and, provided that the promulgation date is not unduly delayed,
1 April 1985 should be attainable. A course of action has been outlined in the event that there is too little time for labelling after the promulgation date. A further course of action has been identified to be applied to the stock of tents carried over from the 1984 season. It is most important that industry be given sufficient lead-time to carry out the necessary technical work and experimentation and make changes to equipment and processes.

6.7 Failure to allot the necessary time to implement could result in a partial loss of market for the textile industry and for the tentage industry. Loss of market is accompanied by loss of jobs in the industry. It would leave the Canadian market open to further imports which could meet the FR requirement. By the time Canadian industry is ready for production, much of the market could be lost.

6.8 Even with an acceptable implementation date, there is an interim period between promulgation of the regulation and its implementation, during which the industry is making its adjustments. The standard should prevail on a voluntary basis during that period to help ensure that tents with less than adequate FR properties do not reach the market. Some form of temporary tariff or non-tariff protection for the industry should be examined.

6.0 CONCLUSIONS (cont'd)

6.9 The introduction of an FR requirement will result in a more expensive product and sales resistance is expected during the first year of implementation. The range of increase is projected as being between 12 and 20% for domestically produced tents at the manufacturing level. In the case of imported nylon tents the increase cou' range from nil to 6.8%. It is expected that the market would adjust and recover during the following two years because there will be no alternative to FR tentage available for sale.

6.10 The US industry standard CPAI-84 should be used as the basis for the technical aspects of the Canadian standard. There is much to be gained from utilizing similar standards to those adopted in USA.

6.11 The process of regulation should be supported by an adequate monitoring and enforcement program to ensure that both domestic and foreign made tents sold in Canada meet the standards established for flame-resistance. The presence of a federal enforcement program does not absolve any sector of the industry from ensuring that their product meets the required standard on an ongoing basis. An effective industrial quality control program should be the main safeguard.

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7.0 RECOMMENDATIONS

7.1 The recommendations made in the body of the report are repeated here for easy reference.

7.2 As there would be much to be gained by both government and industry in jointly attacking this problem by adopting the voluntary/mandatory format or a format which has the same effect, it is recommended that this form of regulation be followed. However the date of mandatory implementation must be predetermined and made public, otherwise all the pitfalls of voluntary regulation will be perpetuated. (Para 3.0 et al)

7.3 It is recommended that the safety-related technical requirements of CPAI-84 be adopted. These will include the requirement for weathering and will substitute the time-to-burn test for the determination of damaged length test. (Para. 4.3. et al)

7.4 It is recommended that the courses of action outlined in para 4.4.22 (1) (2) (3 a.b.) and (4) be considered by industry as soon as possible. (These refer to the development of new fabric-finish standards, installing dust control and exhaust systems, new curing equipment and fume exhaust systems, plant modernization and the application of new technology.) (Para 4.4 et al)

7.5 It is recommended that, if industry requires financial assistance to make the technical and equipment changes necessary to meet new flame-retardant standards, it considers the CIRB and the IRDP programs and also relevant provincial programs. For some requirements it might be advantageous to act collectively. (Para 4.5 et al)

7.0 RECOMMENDATIONS (cont'd)

7.6 It is recommended that the Department of Consumer and Corporate Affairs consider the implementation date for warning labels be changed to 1 October 1985. This would apply if the original promulgation date of the regulation does not permit sufficient time for adjustment in production for the 1985 retail season either by sewing-on labels or by providing a pressure-sensitive label. (Paras 4.7.3 to 4.7.5)

7.7 It is recommended that re-labelling of the carry-over of 1984 stocks for sale in 1985 be accomplished by the use of durable pressure-sensitive labels issued at point of sale to individual customers together with suitable instructions to stick the label to the tent on the inside. This approach could also be applied to 1984 production to meet the 1 April 1985 deadline if a company has not already taken action to sew in labels. It is also recommended that the unpacking, stitching of labels, repacking method be permitted if a company wishes to use this approach. (Paras 4.7.6 to 4.7.8)

7.8 It is recommended that the regulation include provision for mandatory application of the FR requirements to meet the proposed standard by the 1988 retail selling season with the same standard to be applied on a voluntary basis in the interim period prior to the implementation deadline. (Para 4.7.9 et al)

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8.0 ACKNOWLEDGEMENT

This study was dependent upon successful data-gathering. With few exceptions I found that organizations and persons contacted were free and open in discussion and were most anxious to feed into the study all information at their disposal. In many cases I was able to reciprocate in some measure and this form of information exchange resulted in an atmosphere of frankness which facilitated the task.

I wish to express my appreciation to all companies, organizations and individuals which have contributed to this study in any way.

G.T. Holmes, C.Text, F.T.I.,
Executive Consultant
ADGA Systems International Limited

APPENDIX A

News Release Communiqué

Consumer and Corporate Affairs Canada
Consommation et Corporations Canada

NR-84-17

Immediate release

Government to introduce tent flammability standards under the Hazardous Products Act

OTTAWA, June 5, 1984 -- Federal Consumer and Corporate Affairs Minister Judy Erola today announced her intention to develop a regulation establishing a flammability standard for tents under the Hazardous Products Act.

The regulatory process, based in part on the results of burn tests carried out by the department to determine the combustion characteristics of various tents sold in Canada, will proceed in two stages -- a mandatory warning label to be affixed to tents followed by the establishment of a national tent flammability standard.

"Since 1971, on average 33 tent fires have occurred each year, causing four deaths and six serious injuries." Mrs. Erola noted, "A flammability standard for tents will result in improved flame retardant characteristics, reducing the number of these tragic incidents."

The information label, with the message warning that tents will ignite and may burn when exposed to open flames or other ignition sources, is expected to be made mandatory

...2

Canada

as of April 1, 1985 on all tents sold in Canada. Canadian tent manufacturers have voluntarily affixed a warning label to tents.

The second phase, a regulation establishing a national flammability standard under the Hazardous Products Act, will be implemented as quickly as possible, but reasonable time will be given to manufacturers and importers to effect changes in the manufacturing process to include the use of fire retardant materials.

"Although a flammability standard cannot be implemented in time for the 1985 camping season due to long lead times required for ordering materials, shipping and distribution, and the need for a transitional period to allow manufacturers to comply with the regulation," the Minister indicated, "I expect the standard to be applied to those products marketed for the 1986 season."

The Minister added that Canadians can enjoy a full and safe camping season by exercising proper care and caution at all times when using a tent. (See attached tenting safety tips.)

"Meanwhile, my department will be working closely with industry and will assist manufacturers in developing information for consumers on how to use tents safely." she concluded.

- 30 -

Reference: Heather Coulter-Bowen
(819) 997-3146

(Version française disponible)

TENTING SAFETY TIPS

- Do not use candles or matches or open flames of any kind in or near a tent.
- Do not cook inside the tent.
- Build campfires downwind and several meters away from the tent. Always be sure to fully extinguish camp fires before leaving camp or before retiring for the night.
- Practice extreme caution when using fuel-powered lanterns and heaters inside the tent, and use battery-operated equipment whenever possible.
- Never refuel lamps or heaters or stoves inside the tent.
- Extinguish or turn off all lanterns before going to sleep.
- Avoid smoking in the tent.
- Do not store flammable liquids inside the tent.

June 1984

(Version française disponible)

APPENDIX B

Value of tent and tent trailer shipments from manufacturers in Canada 1971-1982.

	Value of Manufactured Goods ($,000.)											
	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971
TENTS												
Tourist and Umbrella	2,879	3,660	3,984	2,497	3,043	2,635	-	1,709	1,710	2,489	2,794	2,038
Cottage or Cabin Style	4,648	5,242	4,621	3,782	2,930	3,341	7,721	4,146	2,878	2,776	1,708	1,177
Other Domestic	5,212*	3,644	2,438	3,954	2,942*	3,116*	913	9,799	1,339	1,355	1,136	1,180
Totals	12,739	12,546	11,043	10,233	8,915	9,092	-	15,654	5,927	6,620	5,638	4,395
Totals in March 1984 constant dollars+	13,936	15,206	15,052	15,370	14,612	16,229	-	32,451	13,614	16,861	15,448	12,618
TENT TRAILERS												
Totals	-	126	264	314	-	-	1,104	1,296	877	1,741	1,315	1,407
Totals in March 1984 constant dollars	-	153	360	472	-	-	2,129	2,687	2,014	4,434	3,603	4,039

- Indicates information is unknown

* Figures include tent trailers. This information was not separated due to confidentiality.

+ Totals were adjusted to March 1984 constant dollars to account for inflation using the consumer price index as published by Statistics Canada in publication 62.001.

Note: Information was obtained from Statistics Canada Publications 34-202 and 34-224. Included are large establishments reporting detail on shipments of minimum size.

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APPENDIX C

Number of Tents on the 1982 Canadian Market
by Fabric Type and Country of Origin

Country of Origin	Fabric Type: 100% Cotton (Non FR)	Nylon	Other	Unknown	Total	% of Total Market by Source
Canada	90,000*	15,000	5,000		110,000	32.87
South Korea		109,170			109,170	32.62
Taiwan		102,727			102,727	30.67
United States				8,867	8,867	2.65
Czechoslovakia	2,552				2,552	0.76
Other				1,303	1,303	0.39
Total	92,552	226,897	5,000	10,170	334,619	100
% of Total Market by Type	28	68	1	3	100	
% of Market Filled by Canadian Industry	97.24	6.61	100	0	32.87	---

Note: Information on imports was gathered from Statistics Canada Publication 65-207. Canadian estimates were supplied by Mr. L. Aldoroty of Woods Inc. (Now 134599 Canada Ltd.)

* According to Mr. Aldoroty, of the 90,000 cotton tents manufactured in Canada, approximately 65,000 have under 108 sq. ft. of floor area while the remaining are larger.

\+ This number has been rounded off to the nearest thousand because the Canadian estimates have this accuracy.

Appendix C (cont.)

Number of tents imported into Canada by country of origin 1970-1984

Country of Origin	Number of Tents Imported by Year														
	Jan., Feb. 1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970
South Korea	27,409	160,892	109,170	168,324	130,657	150,591	94,614	62,627	14,399	2,592	600	-	-	-	-
Taiwan	54,476	132,094	102,727	62,137	57,544	105,471	53,815	102,577	77,515	21,628	37,696	11,387	3,222	-	-
Czechoslovakia	2,797	8,590	2,552	6,362	7,635	3,409	7,931	10,546	26,971	48,855	68,015	67,827	69,738	32,439	43,115
Poland	-	-	-	-	3,450	2,375	2,750	16,650	9,050	13,214	4,540	11,124	8,164	10,180	1,870
East Germany	8,078	6,609	-	-	-	-	-	-	-	-	-	-	-	-	-
West Germany	467	6,564	148	140	-	-	-	-	-	-	-	-	-	-	-
United States	275	4,887	8,867	7,802	6,726	7,454	6,746	12,062	12,954	6,396	7,846	7,975	5,521	3,355	1,057
Hong Kong	1,296	3,619	52	2	-	-	-	-	-	-	-	-	-	-	-
Peoples' R. of China	3,000	3,000	616	-	-	-	-	-	-	-	-	-	-	-	-
Japan	-	106	279	29	1,094	300	18,872	50,838	93,062	68,323	74,607	112,762	123,076	41,309	13,574
Others	3,379	845	208	102	2,065	877	2,439	4,832	7,497	3,301	9,180	16,871	7,606	6,946	6,273
Total	94,419	327,206	224,619	244,898	209,171	270,477	187,167	260,132	241,448	164,309	202,484	227,946	217,327	94,429	65,889

Information was obtained from Statistics Canada under import classification number 961-56-20. The figures for 1984 are the number imported into Canada in January and February only.

APPENDIX D

QUESTIONNAIRE ON REGULATIONS

FOR FLAME-RESISTANT TENTS

1. Does your country have national or state regulations governing flame-resistance in tents?

   Yes ____ National ____ State ____

   No ____

2. a) If yes, are the regulations

   Mandatory ____

   Voluntary ____

   (Please forward a copy of any regulations)

   b) How long have the regulations been in effect?

3. a) Do you have a licencing system or an approval system to monitor compliance?

   Yes ____ No ____

   b) If yes, please give details or enclose a copy of the system.

4. Which types of tents do your regulations cover?

   Camping tents ____

   Marquees ____

   Inflatable shelters ____

   Kitchen and dining shelters ____

   Childrens' play tents ____

   Canvas tops on tent trailers ____

   Tarpaulins ____

   Canopies and awnings ____

5. Do you have statistics on tent fires over the past 10-15 years in terms of total number of fires, cause of fire and deaths/injuries incurred? (If so, please attach the data)

   Yes ____ No ____

.../2

6. Have these incidents significantly diminished since the introduction of your regulations?

Yes _____ No _____

Please give an explanation for the change or the lack of change.

7. Do you have flame-retardant finishes for tentage materials which are specifically approved or specifically banned?

Yes _____ No _____

Please give details.

8. What was the reaction of the following groups regarding the introduction of regulations?

Textile Industry

Proofers

Tent Manufacturers

Major Retailers

Consumers

3/...

9. Did the industrial groups require additional equipment and capital investment to meet the regulations?

Yes _____ No _____

Remarks.

10. a) Did the retail price of tents increase by the introduction of flame-retardence?

Yes _____ No _____

b) If yes, by approximately what percentage? _____

c) Did the increase in selling price reduce the consumers demand for tents and result in lower employment levels in the industry?

Yes _____ No _____

Remarks.

11. What types of flame-retardent finishing processes are normally used for tentage?

Wax emulsion _____

THPC _____

Other phosphorus compounds _____

Other metallic salts _____

Others _____

.../4

4/...

12. Do any of these finishes cause health and safety hazards

in the proofing process? Yes ____ No ____
in the tent manufacturing process? Yes ____ No ____

13. If you are familiar with U.S. Standard CPAI 84, how does this compare with your standard?

more stringent ____

less stringent ____

approximately the same ____

14. Over what time period was your regulation introduced. (the number of years between publication of the regulation and the date by which it would be effective)

____ years

15. Please add any additional comments you feel might be helpful to our study.

GTH/hlt

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APPENDIX E

QUESTIONNAIRE ON TENT FLAMMABILITY

1. a. Do you currently manufacture or import flame-retardant tents and similar shelters.

   Yes..... No.....

   Manufacture..... Import.....

   b. If yes, what is the approximate percentage of your business which is flame-retardant (based upon the number of units, not dollar value)?

   .....% is F.R.

   c. Does your flame-retardant tentage meet the standards contained in CPA1 84?

   Yes..... No.....

   d. What materials are being used in your tents?

	F.R.	Non-F.R.	% of Sales
Camping Tents			
Marquees & other large tents			
Inflatable structures			
Kitchen & Dining Shelters			
Children's Play Tents			
Canvas Trailers			
Canopies and Awnings			

2. It has been announced that all tents sold in Canada in 1985 and beyond shall carry a mandatory warning label. It was also announced that all tents manufactured and sold in 1986 shall be flame-resistant.

   a. Does the labelling requirement cause you any serious problem?

   Yes..... No.....

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QUESTIONNAIRE (cont'd)

b. If yes, please explain:

c. Labelling of 1984 stocks which are carried over would require separate action. Of the following alternatives, which are the most practical to the tent-manufacturers provided that dispensation from the regulation cannot be obtained for carry-over stock? (Check one or more options)

a. Unpack, sew label and repack.....
b. Label or warning notice enclosed in package.....
c. Label on outside of package.....
d. Supply a pressure sensitive label with each sale, to be affixed by the individual customer.....

d. Are you, together with your material suppliers, able to meet the 1986 selling season deadline for F.R. tentage meeting CPA1 84?

Yes..... No.....

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QUESTIONNAIRE (cont'd)

e. If not, please give reasons, and indicate what period of time is necessary in order that your suppliers and your manufacturing facilities can make the technical and production changes necessary for you to deliver F.R. tents to your customers.

NOTE: When U.S. industry made the change approximately ten years ago it was necessary to develop polyester/cotton fabrics to replace the standard 100% cotton range. The loss in tear strength after applying a FWWMR finish necessitated this in order to maintain tensile factors without significant increase in finished weight. This need for development should be considered in your reply.

f. If you have costed the additional of F.R. to your product line, what is the percentage increase in cost of your product line?

.....% increase.

g. If the 1986 deadline was maintained, how would this affect your business in terms of both production and employment?

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QUESTIONNAIRE (cont'd)

h. Do you have adequate exhaust and dust removal systems in the plant, in order to safely handle the F.R. treated fabric?

3. What quantities of fabric do you normally use per year?

a. 100% cotton.....
b. Nylon (coated and uncoated).....
c. Polyester/cotton blend.....
d. Polyester/cotton corespun.....
e. Polyethylene/polypropylene.....
f. Other.....

Signed:.....

Company:.....

Date:.....

Please return to: Mr. G.T. Holmes, ADGA Systems International Ltd.
Suite 400 - 116 Albert Street
Ottawa, Ontario
K1P 5G3

adga

Appendix F

Companies and Organizations Contacted during the Study

A. CANADA

Textile Manufacturers and Proofers

Walter H. Clegg and Associates Ltd.
Consoltex Inc.
Dominion Textile Inc.
Scythes Inc.
Toronto Dyeing and Finishing Ltd.
Wabasso Inc.

Tent Manufacturers

CampMate Ltd
Finnie Manufacturing Co Ltd
Johnson Diversified Canada Inc
Jones Tent and Awning Ltd
Manta Industries Ltd.
North West Tent and Awning Ltd
Pathfinder Company Products Ltd
Ridgeline Products Ltd
Robert Soper Ltd
Smith Anderson Co. Ltd
Western Concord Manufacturing Ltd
Western Tent and Awning Ltd
Woods Inc (now 13499 Canada Ltd)

Importers

Dorcy Ashflash Canada Ltd

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Companies and Organizations Contacted during the Study (cont'd)

Retailers

Canadian Tire Corporation Ltd
Sears Canada Ltd
Zellers Inc.

Government and Non-Government Organizations

Canadian Industrial Renewal Board
Department of National Defence
Department of Regional and Industrial Expansion
National Research Council, Division of Chemistry

United States

Textile Proofers and Tent Manufacturers

Kellwood Recreation Group

Government and Non-Government Organizations

Industrial Fabrics Association International
University of Minnesota; Textiles and Clothing Department

United Kingdom

Textile Manufacturers and Proofers

Hampton Industrial Ltd.
J.T. Inglis and Sons Ltd.

Tent Manufacturers

Coventry Hood and Seating Ltd.

Manufacturers of Flame-Resistant Chemicals and Processes

Albright and Wilson Ltd.

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Companies and Organizations Contacted during the Study (cont'd)

Government and Non-Government Organizations

Department of Trade and Industry
Fire Protection Association
Home Office
Shirley Institute
Textile Institute

Other Countries

Australia	Standards Association of Australia
Austria	Austrian Textile Institute (No reply)
Belgium	Association Nationale de Tisseurs de Lin
Denmark	Danish Textile Institute
Finland	Technical Research Centre of Finland
France	Institut Textile de France (No reply)
Japan	Research Institute for Polymers and Textiles
Netherlands	NV Nederlandee Stroomblekerij
South Africa	South African Bureau of Standards
Switzerland	DuPont de Nemours Int. S.A.
West Germany	Bundesanstalt für Materialprüfung.

APPENDIX G

FIGURES FOR FIRES IN CAMPING TENTS FOR THE PERIOD 1.4.74 to 31.12.74 (9 months) (England and Wales) only

1. Avon 2.4.74 - Ridge Tent ignited by hurrican lamp - tent and contents destroyed
2. Berkshire 26.5.74 - Ridge Tent cause unknown - tent and contents destroyed
3. Berkshire 23.9.74 - Ridge Tent cause unknown - tent and contents destroyed
4. Cornwall 28.7.74 - Frame Tent escaping LPG ignited by lamp - tent and contents destroyed
5. Cumbria 1.9.74 - Frame Tent cause unknown - tent and contents destroyed
6. Derbyshire 27.7.74 - Ridge Tent ignited after LPG escape was ignited tent and contents destroyed 1 MALE INJURED
7. Devon 27.5.74 - Ridge Tent escaping LPG ignited - tent and contents 20% destroyed 1 MALE INJURED
8. Devon 29.8.74 - Ridge Tent (NYLON) escaping LPG ignited - tent and contents destroyed 2 MALE INJURED
9. Dorset 7.8.74 - Ridge Tent escaping LPG ignited - tent and contents destroyed 1 FEMALE & 1 MALE INJURED
10. Essex 9.8.74 - Frame Tent cause unknown - tent and contents destroyed 1 MALE INJURED
11. Lancashire 14.4.74 - Ridge Tent escaping LPG ignited - tent and contents destroyed 2 MALE INJURED
12. Norfolk 18.8.74 - Ridge Tent escaping LPG ignited - tent and contents destroyed
13. North Yorkshire 25.8.74 - Ridge Tent flame on cooker burnt through supply pipe - tent and contents destroyed
14. Northumberland 28.11.74 - Ridge Tent LPG stove fell over and allowed liquid gas to escape and ignited it - tent and contents destroyed
15. West Sussex 6.6.74 - Ridge Tent LPG burner ignited contents - Partial damage to tent and contents
16. West Sussex 30.7.74 - Frame Tent cause unknown - tent and contents destroyed

TENT FIRES (CONT)

17. West Midlands 20.8.74 - Frame Tent suns rays in mirror ignited wall of tent - tent and contents destroyed

18. London 25.7.74 - Frame Tent cause unknown - tent and contents destroyed

19. London 13.8.74 - Frame Tent (NYLON) escaping LPG ignited by candle - tent and contents destroyed 1 FEMALE & 1 MALE INJURED

20. London 20.9.74 - Frame Tent cause unknown - tent and contents destroyed

21. Dyfed 20.8.74 - Ridge Tent ignited by Scout camp fire - tent and contents destroyed.

NOTES

a. Total tent fires for period (1.4.74 - 31.12.74) = 48
Break down 21 in this sample (2 MOD) (25 involved Marquees)

b. 13 Ridge Tents
8 Frame Tents

c. 13 people injured (no fatalities)

d. Predominate cause LPG ignition - 10 out of 14 known causes

FIGURES FOR FIRES IN CAMPING TENTS FOR 1979
ENGLAND, SCOTLAND AND WALES

APPENDIX H

1. GWYNEDD 9.7.79 Frame tent, escaping LPG ignited by gas fridge. Tent and contents destroyed (defective connection).

2. GWYNEDD 20.8.79 Frame tent, escaping LPG from loose connection .5 metre of supply hose burned, cyl removed by occupier.

3. POWYS 14.9.79 Frame tent, escaping LPG from faulty seal on gas lamp ignited by same, unit removed by occupier.

4. SOUTH GLAMORGAN 2.6.79 Frame tent, escaping LPG from faulty valve on 10lb cylinder ignited by gas stove.
Tent and contents destroyed.

5. LOTHIAN & BORDERS 19.5.79 Canvas army ridge tent, lighted candle fell on to sleeping bag.
Tent and contents destroyed, 2 males injured.

6. LOTHIAN & BORDERS 31.10.79 2 man tent of unknown type, occupant fell asleep whilst smoking
Tent and contents destroyed.

7. ROYAL BERKSHIRE 26.7.79 Frame tent ignited by unknown source, destroyed.

8. DEVON 9.8.79 Tent of unknown type ignited by LPG refrigerator placed too close to side of tent.
Tent and refrigerator severely damaged by fire.

9. DEVON 23.8.79 Frame tent ignited by petroleum spirit spilled onto lamp which was left ignited during refilling.
Tent and contents severely damaged by fire.

10. DORSET 26.5.79 Frame tent, escaping LPG from badly connected cylinder ignited by gas cooker.
Tent and contents severely damaged by fire.

11. DORSET 16.7.79 Late call to a tent of unknown type, a pyro camp cook solid fuel tablet exploded, reason unknown.
Tent and sleeping bag slightly damaged by fire, 1 male injured.

12. DORSET 13.9.79 Frame tent, escaping LPG from failed rubber supply tube ignited by gas fridge.
Tent and contents destroyed by fire.

13. EAST SUSSEX 19.4.79 Ridge tent, leaking LPG from gas lamp became ignited by same.
Tent and contents destroyed.
Two females injured, burns and shock.

14. ESSEX 24.8.79 Vagrants temporary shelter in woods occupied by possible alcohol methylated spirits drinker, ignited by unknown means (doubtful).
1 male injured burns.

15. ESSEX 25.8.79 Tent of unknown type, lighted LPG burner placed too close to tent canvas ignited same, 1 sq m. of canvas damaged by fire.

16. HERTFORDSHIRE 4.8.79 Tent of unknown type ignited by cigarette end thrown down by passer-by at Pop Festival.
Tent and contents severely damaged by fire. Spread to 2 additional tents and 4 vehicles, 2 tents and vehicles destroyed by fire.

17. HERTFORDSHIRE 5.8.79 Ridge tent ignited by spark from camp fire at Pop Festival
Tent and contents severely damaged by fire.

18. LANCASHIRE 15.9.79 Tent of unknown type, leaking LPG from loose connection ignited by camping stove.
Tent destroyed contents severely damaged by heat and smoke.

19. NORTHAMPTONSHIRE 1.3.79 Ridge tent, paraffin lamp knocked over by occupier ignited paper and bedding.
Tent and 85% contents destroyed by fire.

20. SHROPSHIRE 10.6.79 Tent of unknown type leaking LPG from defective regulator ignited by match.
2.72 kilo cylinder slightly damaged by fire.

21. SUFFOLK 30.7.79 Frame tent, leaking LPG from lighted incorrectly fitted gas lantern cartridge ignited by same.
Tent and contents destroyed, 1 female injured, burns.

22. WEST SUSSEX 13.7.79 Frame tent, escaping LPG from camping lamp following cylinder change ignited by camping stove.
50% of tent and contents severely damaged by fire.
1 female injured, burns.

23. WEST SUSSEX 14.7.79 Frame tent, escaping LPG from camping stove during cylinder change ignited by unknown source.
Tent and contents severely damaged by fire
1 male injured,burns.

24. WILTSHIRE 26.5.79 Tent of unknown type, LPG leaking from cylinder whilst being changed became ignited.
Tent and contents severely damaged by fire.
2 males injured, burns.

25. MERSEASIDE COUNTY 31.5.79 Ridge tent. Unknown cause (doubtful).
Tent destroyed.

26. WEST MIDLANDS 2.8.79 Frame tent, LPG leaking from cartridge being changed became ignited.
Tent and contents destroyed.

M Bowden
5-6-81

APPENDIX J

The Textile Institute

10 Blackfriars Street
Manchester, M3 5DR, UK
telephone 061-834 8457
telex 668297 TEXINS G

The Textile Institute Information Service

adga

RECEIVED
JUL 19 1984
OTTAWA

11 July 1984

Our ref: 0012/2
Your ref: telex of 9.7.84

Mr G T Holmes CText FTI
Adga Systems International Ltd
Siege Social
Suite 400
116 Albert
Ottowa K1P 5G3
Canada

Dear Mr Holmes,

In reply to your telex, I am enclosing some references concerning flame retardence in tent materials. The complete articles can be supplied on request.

As far as the UK is concerned, statistics on tent fires are not normally available. However, in 1982, a special report was commissioned within the Home Office and the following figures are available for 1982.

Total Number of Fires	=	58
Fatal	=	3
Non Fatal	=	20

Causes

17	-	cooking appliances
11	-	smokers materials and matches
4	-	heating appliances
2	-	lighting appliances
1	-	fridge
3	-	other domestic appliances
1	-	burning rubbish
1	-	paint stripper/blow lamp
1	-	high tension cable
1	-	spread from another fire
16	-	cause doubtful/unknown

continued....

APPENDIX K

ANALYSIS OF STATISTICS BY UNIVERSITY OF MINNESOTA.

TABLE 1

STATE OF OCCURRENCE

State	Tent Fires With Bodily Injury	Tent Fires Without Bodily Injury	Total
Minnesota	7	15	22
Texas	5	0	5
New Mexico	4	0	4
Florida	4	0	4
California	3	0	3
Colorado	3	0	3
Michigan	2	1	3
New York	2	1	3
South Carolina	2	1	3
Wyoming	1	2	3
Alabama	2	0	2
Maine	2	0	2
Ohio	2	0	2
1 Fire With Bodily Injury each from: AR, CT, GA, IA, KS, LA, MA, MT, NE, NH, OR, PA, WI, British Columbia, Ontario, and Sonora	16	0	16
Total	55	20	75

TABLE 2

YEAR OF OCCURENCE

Year	Tent Fires With Bodily Injury	Tent Fires Without Bodily Injury	Total
1943-1959	1	2	3
1960-1964	1	2	3
1965-1969	8	2	10
1970-1974	45	14	59
Total	55	20	75

APPENDIX K

ANALYSIS OF STATISTICS BY UNIVERSITY OF MINNESOTA.

TABLE 1

STATE OF OCCURRENCE

State	Tent Fires With Bodily Injury	Tent Fires Without Bodily Injury	Total
Minnesota	7	15	22
Texas	5	0	5
New Mexico	4	0	4
Florida	4	0	4
California	3	0	3
Colorado	3	0	3
Michigan	2	1	3
New York	2	1	3
South Carolina	2	1	3
Wyoming	1	2	3
Alabama	2	0	2
Maine	2	0	2
Ohio	2	0	2
1 Fire With Bodily Injury each from: AR, CT, GA, IA, KS, LA, MA, MT, NE, NH, OR, PA, WI, British Columbia, Ontario, and Sonora	16	0	16
Total	55	20	75

TABLE 2

YEAR OF OCCURENCE

Year	Tent Fires With Bodily Injury	Tent Fires Without Bodily Injury	Total
1943-1959	1	2	3
1960-1964	1	2	3
1965-1969	8	2	10
1970-1974	45	14	59
Total	55	20	75

TABLE 3

MONTH OF OCCURRENCE

Month	Tent Fires With Bodily Injury	Tent Fires Without Bodily Injury	Total	Percent Of Fires
January	2	0	2	2.7
February	0	0	0	0.0
March	4	0	4	5.3
April	13	2	15	20.0
May	1	2	3	4.0
June	10	2	12	16.0
July	9	4	13	17.3
August	9	6	15	20.0
September	1	1	2	2.7
October	1	0	1	1.3
November	3	2	5	6.7
December	2	1	3	4.0
Total	55	20	75	100.0

TABLE 4

PERCENT BODY SURFACE AREA BURNED BY INJURY EXTENT

% Body Surface Area Burned	Injury Extent			Total Persons
	Fatal	Severe	Minor	
50+	13	9	0	22
20-49	1	16	0	17
1-19	0	11	11	22
Total Persons	14	36	11	61

TABLE 5

INJURY SEVERITY BY TIME OF DAY

Injury Extent	8AM-8PM	8PM-8AM	Unknown	Total Persons
Fatal	3	21	3	27
Severe	3	49	20	72
Minor	0	17	3	20
Total Persons	6	87	26	119

% Body Surface Area Burned	8AM-8PM	8PM-8AM	Unknown	Total Persons
50+	3	19	0	22
20-49	2	11	4	17
1-19	0	20	2	22
Total Persons	5	50	6	61

TABLE 6

INJURY SEVERITY BY STATE OF CONSCIOUSNESS

Injury Extent	Persons Awake	Persons Asleep	Unknown	Total Persons
Fatal	2	17	8	27
Severe	7	32	33	72
Minor	3	11	6	20
Total Persons	12	60	47	119

% Body Surface Area Burned	Persons Awake	Persons Asleep	Unknown	Total Persons
50+	2	16	4	22
20-49	2	10	5	17
1-19	2	12	8	22
Total Persons	6	38	17	61

TABLE 7

INJURY SEVERITY BY AGE OF INJURED PERSONS

Injury Extent	Age in Years 0-5	6-14	15-24	25+	Unknown	Total Persons
Fatal	12	10	1	4	0	27
Severe	8	39	12	12	1	72
Minor	1	6	7	5	1	20
Total Persons	21	55	20	21	2	119

% Body Surface Area Burned	0-5	6-14	15-24	25+	Unknown	Total Persons
50+	10	10	1	1	0	22
20-49	1	8	6	2	0	17
1-19	3	8	5	6	0	22
Total Persons	14	26	12	9	0	61

TABLE 8

INJURY SEVERITY BY SEX OF INJURED PERSONS

Injury Extent	Female	Male	Unknown	Total Persons
Fatal	8	16	3	27
Severe	13	44	15	72
Minor	9	10	1	20
Total Persons	30	70	19	119

% Body Surface Area Burned	Female	Male	Unknown	Total Persons
50+	6	16	0	22
20-49	4	12	1	17
1-19	8	13	1	22
Total Persons	18	41	2	61

TABLE 9

INJURY SEVERITY BY SOURCE OF IGNITION

Injury Extent	Lantern	Campfire	Candle	Heater	Other	Unknown	Total Persons
Fatal	13	3	2	1	5	3	27
Severe	16	13	16	2	8	17	72
Minor	5	9	3	0	0	3	20
Total Persons	34	25	21	3	13	23	119

% Body Surface Area Burned	Lantern	Campfire	Candle	Heater	Other	Unknown	Total Persons
50+	7	4	4	1	6	0	22
20-49	8	1	3	0	4	1	17
1-19	9	7	5	0	0	1	22
Total Persons	24	12	12	1	10	2	61

TABLE 10

INJURY SEVERITY BY TENT TYPE

Injury Extent	Pup	Umbrella	Cabin	Tent Trailer	Other	Unknown	Total Persons
Fatal	3	4	9	5	0	6	27
Severe	12	23	17	2	4	14	72
Minor	3	5	7	2	0	3	20
Total Persons	18	32	35	9	4	23	119

% Body Surface Area Burned	Pup	Umbrella	Cabin	Tent Trailer	Other	Unknown	Total Persons
50+	5	5	6	1	1	4	22
20-49	4	11	2	0	0	0	17
1-19	5	4	11	1	0	1	22
Total Persons	14	20	19	2	1	5	61

TABLE 11

INJURY SEVERITY BY FIBER TYPE IN PREDOMINATING FABRIC

Injury Extent	Cotton	Nylon	Unknown	Total Persons
Fatal	17	0	10	27
Severe	45	0	27	72
Minor	16	0	4	20
Total Persons	78	0	41	119

% Body Surface Area Burned	Cotton	Nylon	Unknown	Total Persons
50+	16	0	6	22
20-49	16	0	1	17
1-19	17	0	5	22
Total Persons	49	0	12	61

TABLE 12

INJURY SEVERITY BY ACCIDENT LOCATION

Injury Extent	Backyard	Campsite	Unknown	Total Persons
Fatal	10	14	3	27
Severe	13	41	18	72
Minor	2	16	2	20
Total Persons	25	71	23	119

% Body Surface Area Burned	Backyard	Campsite	Unknown	Total Persons
50+	10	12	0	22
20-49	4	12	1	17
1-19	5	16	1	22
Total Persons	19	40	2	61

Source: Robert F. Johnson and Sally A. Hasselbrack. Flammable Camping Tents - Statistics, Legislation, Testing and Design. 8th annual meeting, information council on Fabric Flammability.

APPENDIX L

CPAI-84

A SPECIFICATION FOR FLAME RESISTANT MATERIALS USED IN CAMPING TENTAGE

Camping Products Manufacturers' Division
Industrial Fabrics Association International
345 Cedar Building, Suite 450
St. Paul, MN USA 55101

Phone: (612) 222-2508

This Standard represents the judgement of the members of the Camping Products Manufacturers' Division of the Industrial Fabrics Association International as to the basic performance requirements for products to be certified under this Standard. Inasmuch as the Industrial Fabrics Association International does not inspect, approve, or certify any procedures, equipment, materials, or products nor does it approve or evaluate actual testing, it assumes no liability or responsibility for the effect of observance or non-observance of any or all of the Standards set forth herein.

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7. Test Method, Wall and Top Material

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7.3 Procedure
7.4 Report
7.5 Notes

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1. Scope

1.1 Scope . This standard provides performance requirements and test methods for evaluating the flame resistance of fabric and other pliable materials used in camping tentage. It also provides for certification of materials by suppliers and for labeling programs to caution the user against actions detrimental to flame retardant finishes, as well as to facilitate the identification of tentage as being constructed of flame resistant materials and to identify the manufacturer.

2. Definitions

2.1 Camping Tentage: Any portable temporary shelter or structure designed to protect persons from the elements, all or a portion of the covering of which is made of fabric or other pliable materials. This includes, though not exclusively, the following: camping tents; play tents; recreational vehicle awnings; dining flies and canopies; fabric screen houses: add-a-rooms; ice fishing tents .

2.2 Material Classifications. All materials covered in this standard fall under one of the following definitions;

2.2.1 Flooring Material: Any pliable material used for flooring in camping tentage but excluding such things as rugs or carpets placed in the tent which are not an integral part of the item.

2.2.2 Wall and Top Material: Any pliable material used in camping tentage for other than flooring including walls, roofs, tops, doors, windows, screens awnings, flies and canopies.

2.3 Sample Unit. A sample unit shall consist of the following:

2.3.1 Flooring Material: Four individual specimens. no two specimens containing the same warp or fill yarns or filaments.

2.3.2 Wall and Top Material: Eight individual specimens, four taken from the warp and four from the fill direction of the test material. No two warp specimens shall contain the same warp yarns or filaments and no two fill specimens shall contain the same fill yarns or filaments.

3. Performance Requirements

3.1 Flooring Material. When subjected to the test described in Section 6, no specimen from a sample unit of flooring material shall be damaged within 1.0 inch of the edge of the hole in the flattening frame.

3.2 Wall and Top Material When subjected to the test described in Section 7, no specimen from a sample unit of wall and top material shall have an after-flame time (length of time a specimen continues to flame after removal of the test flame source) of more than 4.0 seconds; the average after-flame time for all specimens in a sample unit shall not exceed 2.0 seconds. The damaged length (distance from the bottom of the specimen to a point above which all material is sound) for the sample unit and individual specimens shall not exceed the values shown in Section 3.2.1 Portions or residues which break or drip from the test specimens shall not continue to flame after they reach the floor of the test cabinet.

3.2.1 Damaged Length. The maximum permissible damaged lengths for wall and top material shall be as follows:

Untreated Weight of Material Being Tested - Ounces Per Square Yard	Maximum Average Damaged Length for Sample Unit - Inches	Maximum Damaged length for an Individual Specimen - Inches
Over 10	4.5	10.0
Over 8 but not over 10	5.5	10.0
Over 6 but not over 8	6.5	10.0
Over 4 but not over 6	7.5	10.0
Over 1.5 but not over 4	8.5	10.0
Not over 1.5	9.0	10.0

4. Certification and Labeling

4.1 Material Certification Each lot of flame resistant material supplied to a manufacturer of camping tentage shall be accompanied by a written certification from the supplier stating that it meets the flame retardance requirements of CPAI-84 and giving the lot number and yardage therein.

4.2 Labeling of Camping Tentage. A label or labels shall be permanently affixed to each item of camping tentage containing the following information:

4.2.1 Certification: A statement that the materials used in the manufacture of the item meet the flame resistance requirements of CPAI-84.

4.2.2 Manufacturer Identification: An identification of the manufacturer of the item, unless the item bears a private label, in which case, it shall identify the private labeler and shall also contain a code mark which will permit the seller of the item to identify the manufacturer thereof to the purchaser upon his request.

4.2.3 Code Number: A number enabling the manufacturer to identify from his records the suppliers and suppliers' lot numbers of the certified materials used in the item. The manufacturer shall also maintain records identifying the parties to whom he sold camping tentage. Further, he shall maintain records identifying items manufactured from lots of certified material. Records shall be maintained for 4 years.

4.2.4 Warning Label:

24 pt. type

16 pt. type

12 pt. type

> WARNING
>
> KEEP ALL FLAME AND
> HEAT SOURCES AWAY
> FROM THIS TENT FABRIC
>
> This tent is made with flame resistant fabric which meets CPAI-84 specifications. It is not fire proof. The fabric will burn if left in continuous contact with any flame source.
>
> The application of any foreign substance to the tent fabric may render the flame resistant properties ineffective.

This warning label or its equivalent must be permanently affixed to the tent at one conspicuous location, and must contain block letters on a white background. The first paragraph of the body of the label must be placed in a conspicuous location on each carton containing the tent.

5. Conditioning

5.1 Standard Conditions for Testing. Flame tests shall be performed under or upon immediate removal from Standard Atmospheric Conditions and on specimens in moisture equilibrium under Standard Atmospheric Conditions.

5.1.1 Standard Atmospheric Conditions. Standard Atmospheric Conditions for testing are 65 percent ± 2 percent relative humidity at a temperature of 70°F. ± 2°F. (21.1°C ± 1.1°C.)

5.1.2 Moisture Equilibrium. Moisture equilibrium is considered to have been reached when, after free exposure of the material to air in motion controlled at Standard Atmospheric Conditions as defined above, the change in weight of successive weighings made at intervals of 1 hour is no greater than 0.25 percent.

5.1.3 Preconditioning. In the event of dispute concerning the results of tests that may be affected by the moisture content, the material shall be preconditioned by being brought to moisture equilibrium with an atmosphere having a relative humidity of not over 10 percent and a temperature not over 125°F. (52°C.). The material shall then be brought to moisture equilibrium under Standard Atmospheric Conditions as defined above and then tested.

5.2 Leaching. Tests in Sections 6 and 7 shall be performed both before and after leaching.

5.2.1 Test Specimen. Test specimens to be leached shall be of the following dimension:

5.2.1.1 Flooring Material. Each test specimen shall be a 9 inch by 9 inch (± 1/16 inch) section of the flooring material to be tested.

5.2.1.2 Wall and Top Material. Test specimens shall be rectangles of cloth 2 3/4 inches by 12 inches (± 1/16 inch) with the long dimensions parallel to either the warp or filling directions of the material.

5.2.2 Apparatus

5.2.2.1 Water container or tank of such shape and size that the specimen can be submerged therein with all surfaces of the specimen having full access to the water. For cloth specimens the container shall allow not less than 1/2 gallon of water for each square foot of specimen. The water shall be changed by a continuous flow or by emptying and refilling so that there shall be at least six complete changes of water in a 72-hour period.

5.2.2.2 Means of maintaining water at a temperature of 60°F. to 70°F. (15.5°C. to 21.1°C.) and a pH of 6.0 to 8.0 during the test.

5.2.2.3 Means for holding the specimen submerged throughout the leaching period.

5.2.3 Procedure. The specimens shall be immersed in water at a temperature of 60°F. to 70°F. (15.5°C. to 21.1°C.) and a pH of 6.0 to 8.0 for 72 hours. The specimen shall then be removed, air-dried and brought to Standard Atmospheric Conditions prior to further testing.

5.3 Accelerated Weathering. Tests in Sections 6 and 7 shall be performed both before and after accelerated weathering.

5.3.1 Test Specimen. Test specimens to be weathered shall be of the following dimensions:

5.3.1.1 Flooring material. Each test specimen shall be a 9 inch by 9 inch (± 1/16 inch) section of the flooring material to be tested.

5.3.1.2 Wall and Top Material. Test specimens shall be rectangles of cloth 2 3/4 inches by 12 inches (± 1/16 inch) with the long dimensions parallel to either the warp or filling directions of the material.

5.3.2 Apparatus

5.3.2.1 Vertical carbon arc mounted at the center of a vertical cylinder. The arc shall be designed to accommodate either two or three pairs of carbons but shall burn only one pair at a time, automatically transferring from one pair to another as the carbons are consumed. The carbons shall be Sunshine-cored and copper-coated, No. 22 for the upper pair and No. 13 for the lower pair. The arc shall be operated on 60 amperes and 50 volts across the arc for alternating current and on 50 amperes and 60 volts across the arc for direct current.

5.3.2.2 A rotating rack with holder in which the specimens are suspended vertically and normally to radiation from the arc with the center of the face of the specimen at a radial distance of approximately 18 inches from the arc.

5.3.2.3 Water-spray nozzles shall be mounted horizontally (the water-spray assembly vertically) in the test chamber inside the specimen rack and so placed that the water shall strike the specimens evenly over their entire length in the form of a fine spray in sufficient volume to cover specimens immediately on impact. The apparatus shall be so operated that the specimens are exposed to successive cycles of 102 minutes of light without spray and 18 minutes of light with spray.

5.3.2.4 Means for maintaining the required temperature of water in the spray.

5.3.2.5 Means for maintaining the required pressure of water entering the spray.

5.3.2.6 Means for delivering the required quantity of water per spray nozzle to the specimen.

5.3.2.7 Exhaust fan to ventilate the arc effectively.

5.3.2.8 Black panel thermometer unit for measuring the temperature within the machine. This unit shall consist of a metal panel to the base of which is attached the sensitive portion of a bimetallic dial-type thermometer. The entire base is then coated twice with long lasting baked enamel paint.

5.3.3 Procedure

5.3.3.1 The rack shall rotate about the arc at a uniform speed of one revolution per minute.

5.3.3.2 The temperature of water in the spray shall be 80° ± 10°F. (26.7° ± 5.6°C.)

5.3.3.3 The pressure of the water entering the spray shall be 1 - 18 psi inclusive.

5.3.3.4 The quantity of water delivered to the specimen shall be .12 to .25 gallons, inclusive, per hour per spray nozzle.

5.3.3.5 The black panel temperature at the exposure plane of the specimen rack shall be 155° ± 10°F. (68° ± 5.7°C.) when measured in the following manner:

Before reading the temperature the machine shall be full of specimens and shall be in operation long enough for thermal equilibrium to be established. The black panel shall be mounted in the test-panel rack and readings taken at the point where water spray is not striking the panel.

5.3.3.6 The specimen shall be suspended on the rotating rack without tension and in such a way that the ends or corners cannot curl. The long dimension of the specimen shall be in the vertical position and shall be indicated on the reverse side of the cloth. No test portion of the specimen shall be over 7 inches above or below the horizontal plane of the arc.

5.3.3.7 The specimen shall be exposed to normal radiation from the arc for 100 hours.

5.3.3.8 At the end of the exposure period, the specimen shall be removed from the machine, allowed to dry, and brought to Standard Atmospheric Conditions prior to further testing.

6. Test Method, Flooring Material

6.1 Test Specimen. Each test specimen shall be a 9 inch by 9 inch (± 1/16 inch) section of the flooring material to be tested.

6.2 Apparatus

6.2.1 Test Chamber. The test chamber shall consist of an open top hollow cube made of noncombustible material with inside dimensions 12 x 12 x 12 inches and a minimum of 1/4 inch wall thickness. The flat bottom of the box shall be made of the same material as the sides and shall be easily removable. The sides shall be fastened together with screws or brackets and taped to prevent air leakage into the box during use.

6.2.2 Supporting Frame. A steel plate, 9 inches by 9 inches, 1/4 inch thick with an 8 inch diameter hole in its center and a 1 inch by 1 inch by 1/16 inch thick shim affixed to the underside of each corner is required to support the material above the floor of the chamber during the course of the test. The edge of the supporting frame must be kept clean.

6.2.3 Flattening Frame. A steel plate 9 inches by 9 inches, 1/4 inch thick with an 8 inch diameter hole in its center is required to hold the flooring material flat during the course of the test.

6.2.4 Punch . A punch capable of making a 1/4 inch diameter hole in the center of the specimen of flooring material to be tested.

6.2.5 Standard Igniting Source. No. 1588 methenamine timed burning tablet or an equal tablet. These tablets shall be stored in a desiccator over a desiccant for 24 hours prior to use. (Small quantities of sorbed water may cause the tablets to fracture when first ignited. If a major fracture occurs, any results from the test shall be ignored, and it shall be repeated.)

6.2.6 Hood: A hood capable of being closed and having its draft turned off during each test and capable of rapidly removing the products of combustion following each test. The front or sides of the hood should be transparent to permit observation of the tests in progress.

6.2.7 Mirror: A small mirror mounted above the test chamber at an angle to permit observation of the specimen from outside of the hood.

6.3 Procedure

6.3.1 Place the test chamber in the draft-protected environment (hood with draft off) with its bottom in place and the supporting frame centered in the bottom of the chamber, shimmed side down.

6.3.2 Punch a 1/4 inch diameter hole in the center of the specimen of flooring material to be tested.

6.3.3 Place the specimen on the supporting frame in the position in which it will be used, exercising care that the specimen is horizontal and flat. Place the flattening frame on the specimen and position a methenamine tablet on one of its flat sides with its edge within 1/8 inch of the hole in the center of the specimen.

6.3.4 Ignite the tablet by touching a lighted match or an equivalent igniting source carefully to its top.

6.3.5 Continue each test until the last vestige of flame or glow disappears (this is frequently accompanied by a final puff of smoke) or the flaming or smoldering has approached within 1.0 inch of the edge of the hole in the flattening frame at any point. (Any test in which the tablet is extinguished by physical action of the specimen of flooring material shall be disregarded and the test repeated.)

6.3.6 When all combustion has ceased, ventilate the hood and measure the shortest distance between the edge of the hole in the flattening frame and the damaged area. Record the distance measured for each specimen.

6.3.7 Remove the specimen from the chamber and remove any burn residue from the floor of the chamber. Before proceeding to the next test, the floor must be cooled to normal room temperature or replaced with one that is at normal room temperature.

6.4 Report. The number of specimens of the four tested in which the damaged area does not extend to within 1.0 inch of the edge of the hole in the flattening frame shall be reported.

6.5 Notes

6.5.1 The No. 1588 methenamine tablet may be procured from a local pharmacy or from Eli Lilly & Co., 740 S. Alabama, Indianapolis, Indiana 46206.

7. Test Method, Wall and Top Material

7.1 Test Specimen. The test specimens shall be rectangles of cloth 2 3/4 inches by 12 inches (± 1/16 inch) with the long dimensions parallel to either the warp or filling directions of the material.

7.2 Apparatus

7.2.1 Cabinet: A cabinet and accessories, fabricated in accordance with the requirements specified in Figures A, B and C. Galvanized sheet metal or other suitable metal shall be used. The entire inside back wall of the cabinet shall be painted black to facilitate the viewing of the test specimen and pilot flame.

7.2.2 Burner The burner shall be equipped with a variable orifice to adjust the flame height, a barrel having a 3/8 inch inside diameter, and a pilot light.

7.2.2.1 The burner may be constructed by combining a 3/8 inch inside diameter barrel 3 ± 1/4 inches long from a fixed orifice burner with a base from a variable orifice burner.

7.2.2.2 The pilot light tube shall have a diameter of approximately 1/16 inch and shall be spaced 1/8 inch away from the burner edge with a pilot flame 1/8 inch long.

7.2.2.3 The necessary gas connections and the applicable plumbing shall be as specified in Figure D except that a solenoid valve may be used in lieu of the stopcock valve to which the burner is attached. The stopcock valve or solenoid valve, whichever is used, shall be capable of being fully opened or fully closed in 0.1 second.

7.2.2.4 On the side of the barrel of the burner, opposite the pilot light there shall be a metal rod of approximately 1/8 inch diameter spaced 1/2 inch from the barrel and extending above the burner. The rod shall have two 5/16 inch prongs marking the distances of 3/4 inch and 1 1/2 inches above the top of the burner.

7.2.2.5 The burner shall be fixed in a position so that the center of the barrel of the burner is directly below the center of the specimen.

7.2.3 A control valve system with a delivery rate designed to furnish gas to the burner under a pressure of 2 1/2 ± 1/4 lbs. per square inch at the burner inlet (see 7.5.1). The manufacturer's recommended delivery rate for the valve system shall include the required pressure.

7.2.4 The gas used shall be Matheson Manufactured Gas Type B or the equivalent

7.2.5 Metal hooks and weights to produce a series of total loads to determine damaged length. The metal hooks shall consist of No. 19 guage steel wire or equivalent and shall be made from 3 inch lengths of the wire and bent 1/2 inch from one end to a 45 degree hook. One end of the hook shall be fastened around the neck of the weight to be used.

7.2.6 Stop watch or other device to measure the burning time to 0.2 second.

7.2.7 Scale, graduated in 0.1 inch to measure the damaged length.

7.2.8 Clamps For holding the specimen to the supporting frame shall be Acco #325, Hunt Bulldog Clips No.2, or equivalent. A total of four clamps, two on each side are used. Two clamps 3/4 inch above the bottom edge and two clamps 1 1/2 inch above the first two.

7.3 Procedure

7.3.1 The specimen in its holder shall be suspended vertically in the cabinet in such a manner that the entire length of the specimen is exposed and the lower end is 3/4 inch above the top of the gas burner. The apparatus shall be set up in a draft free area.

7.3.2 Prior to inserting the specimen, the pilot flame shall be adjusted to approximately 1/8 inch in height measured from its lowest point to the tip. The burner flame shall be adjusted by means of the needle valve in the base of the burner to give a flame height of 1 1/2 inches (± 1/16 inch) with the stopcock fully open and the air supply to the burner shut off and taped. The 1 1/2 inch flame height is obtained by adjusting the valve so that the uppermost portion (tip) of the flame is level with the tip of the metal prong (see Figure B) specified for adjustment of flame height. It is an important aspect of the evaluation that the flame height be adjusted with the tip of the flame level with the tip of the metal prong. After inserting the specimen, the stopcock shall be fully opened, and the burner flame applied vertically at the middle of the lower edge of the specimen for 12 seconds (± .2 second) and the burner turned off. The cabinet door shall remain shut during testing.

7.3.3 The after-flame time for each specimen shall be recorded to the nearest 0.2 seconds. After flaming and glowing have ceased, the specimen shall be removed from the cabinet.

7.3.4 After each specimen is removed, the test cabinet shall be cleared of fumes and smoke prior to testing the next specimen.

7.3.5 After both flaming and glowing have ceased, the damaged length shall be measured. The damaged length shall be the distance from the end of the specime which was exposed to the flame, to the end of a tear (made lengthwise) of the specimen through the center of the damaged area as follows: The specimen shall be folded lengthwise and creased by hand along a line through the highest peak of the damaged area. The hook shall be inserted in the specimen (or a hole, 1/4 inch diameter or less, punched out for the hook) at one side of the damaged area 1/4 inch from the adjacent outside edge and 1/4 inch in from the lower end. A weight of sufficient size such that the weight and hook together shall equal the total tearing load required in 7.3.6.1 shall be attached to the specimen.

7.3.6 A tearing force shall be applied gently to the specimen by grasping the corner of the cloth at the opposite edge of the char from the load and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge and the damaged length measurement made along the undamaged edge.

7.3.6.1 Loads for Determing Damaged Length. The specific load applicable to the weight of the test material shall be as follows:

Untreated Weight of Material Being Tested - Ounces per Square Yard	Total Tear Weight for Determing the Damaged Length - Pounds
Not exceeding 3.0	0.125
Over 3.0 and not exceeding 6.0	0.25
Over 6.0 and not exceeding 10.0	0.50
Over 10.0	0.75

7.3.7 The damaged length for each specimen shall be recorded to the nearest 0.1 inch.

7.4 Report

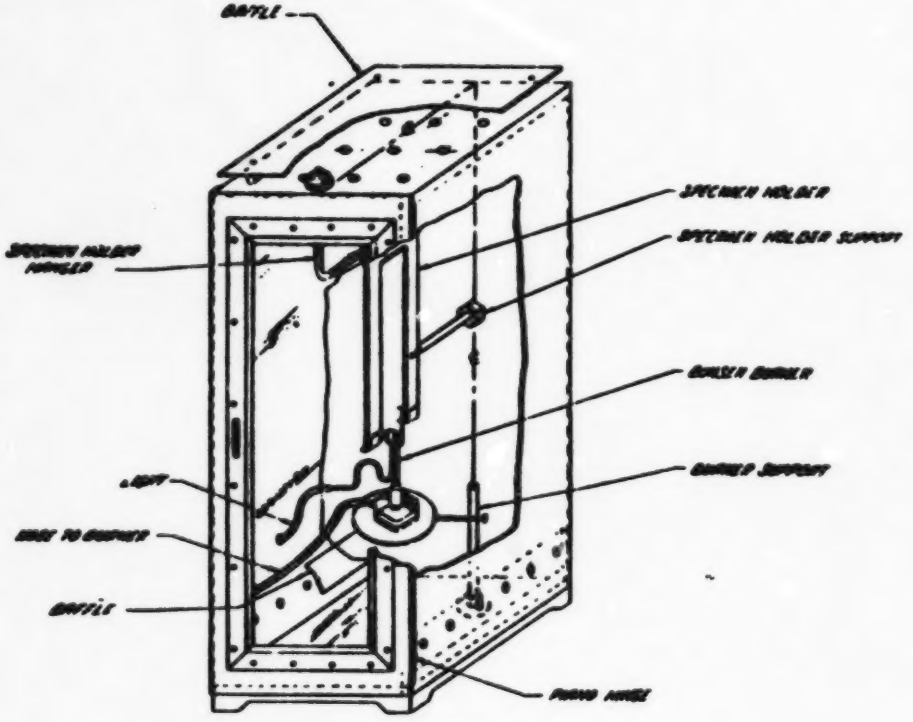
7.4.1 The after-flame time and damaged length of the sample unit shall be the average of the results obtained from the individual specimens tested. All values obtained from the individual specimens shall be recorded.

7.4.2 The after-flame time shall be reported to the nearest 0.2 second and the damaged length to the nearest 0.1 inch.

7.5 Notes

7.5.1 The gas and the regulator valve system, Models IL-350 and 70 with hose and fittings connected in series may be obtained from Matheson Gas Products, P. O. Box 85, East Rutherford, New Jersey 07073.

7.5.2 The test cabinet of the type described in this test method may be obtained from U. S. Testing Company, 1941 Park Avenue, Hoboken, New Jersey, 07030 or from the Govmark Organization, Inc., P. O. Box 807, Bellmore, New York 11710.



ILLUSTRATION

FIGURE A – Vertical flame resistance textile apparatus.

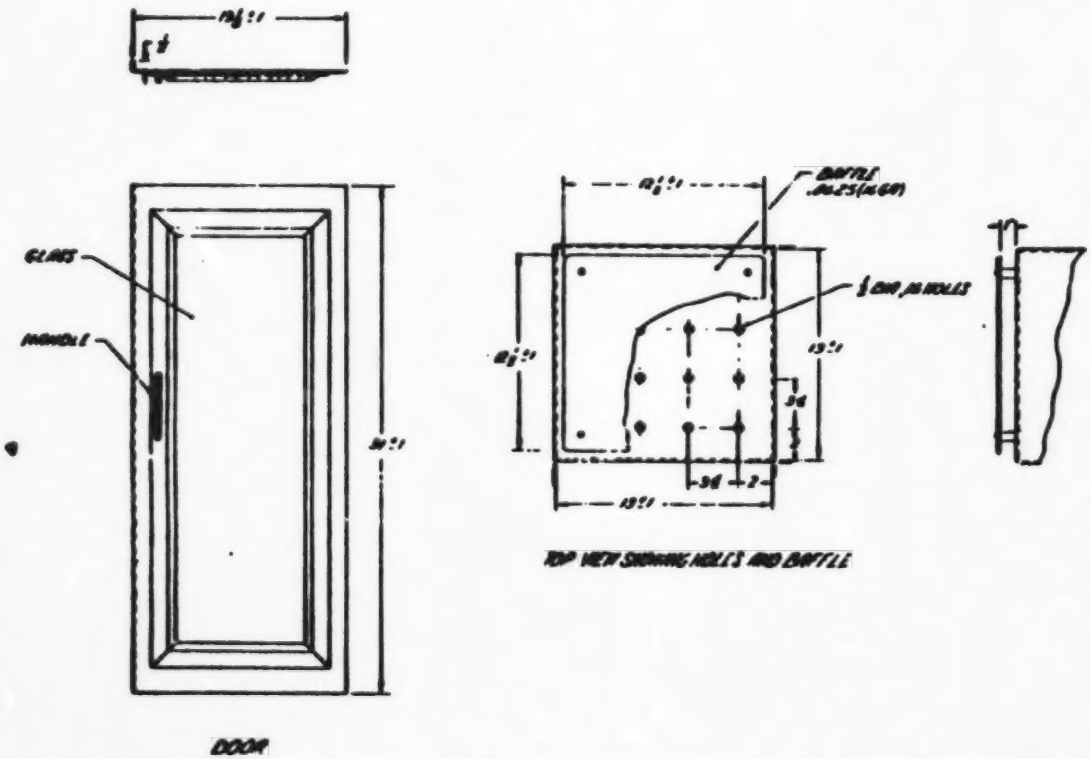


FIGURE 8 - Vertical flame resistance textile apparatus, door and top view w/baffle.

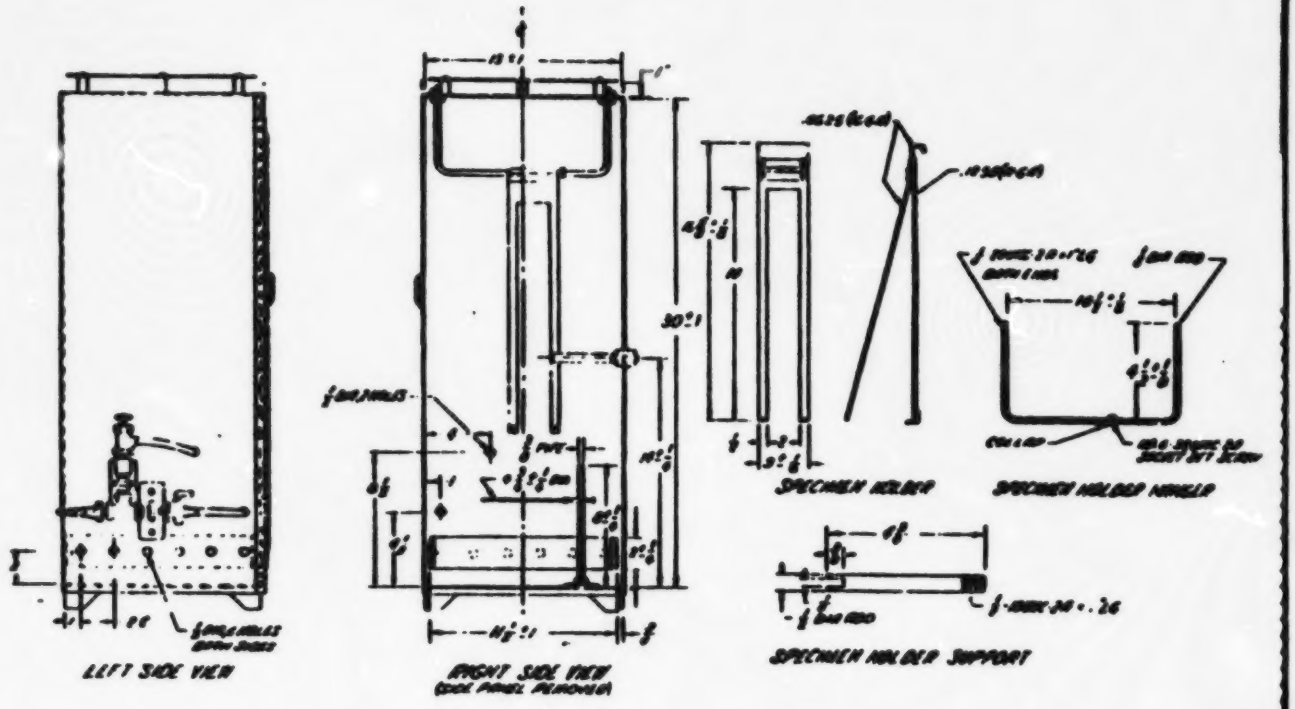


FIGURE C - Vertical flame resistance textile apparatus, views and details.

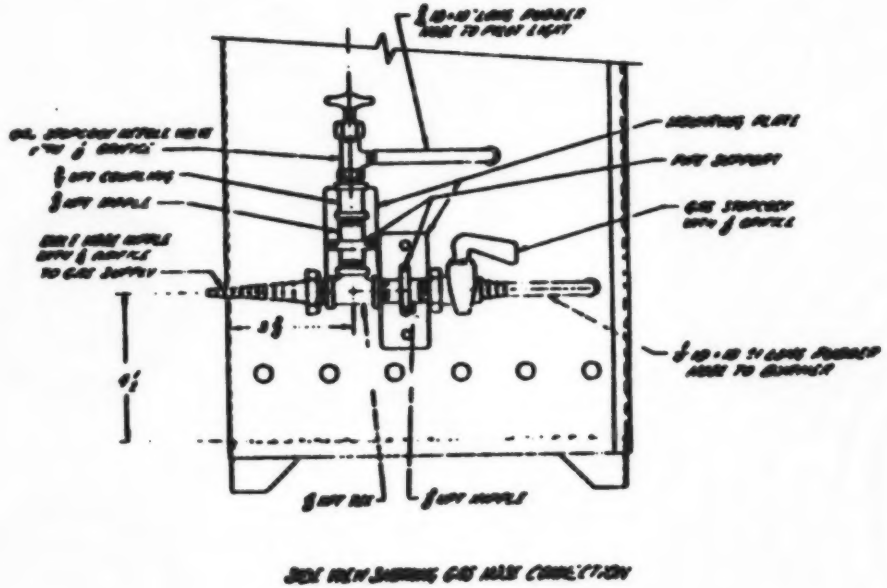


FIGURE D - Vertical flame resistance textile apparatus.

PROBAN® DATA

Information from Albright & Wilson on flame-retardant textiles

APPENDIX M

JES/DR
16.2.83.

PROBAN TREATED FABRICS

Protective Clothing and Childrens Nightdresses made from PROBAN-treated fabrics have been worn for the last 25 years. PROBAN fabrics are also widely used for bedding and for the protection of polyurethane foam from ignition. PROBAN garments are worn under a variety of conditions ranging from hot and dirty atmospheres in industry to 24 hour body contact in sterile wards in hospitals.

Since the first introduction of PROBAN-treated garments we have taken a very responsible attitude in ensuring that Proban treated fabrics are safe to wear both from the standpoint of reduced flammability compared with untreated fabrics and that their use does not cause skin irritation or other harmful effects. As an extreme example young children may suck or chew PROBAN-treated nightdresses or bed linen.

We have an on-going programme of testing PROBAN-treated fabrics to ensure that the fabrics are tested by the latest techniques to meet the increasingly exacting standards imposed on apparel by specifying authorities. The results of these tests are summarized below:-

Oral Toxicity of Treated Fabrics

Acute (rats) - similar to common salt or sodium bicarbonate.

Chronic - (mice) - no toxic effects observed after 8 weeks feeding trials.

Skin Tests with Treated Fabrics

Patch Test (Human Volunteers) - no primary irritancy found (2 independent series).

Delayed Contact Hypersensitivity (Guinea Pigs) - absent.

Mutagenic Activity of Aqueous and Saline Fabric Extracts

In vitro (Ames Test) - No activity.

In vivo (mice 14 days) - No activity found by 4 different assay methods.

Combustion Products from Burning Fabrics

Chemical Analysis - same combustion products as untreated cotton.

Inhalation Toxicity (rats) - same toxicity level as untreated cotton.

Details of these tests are available on request.

It is impossible to say how many lives have been saved or serious injury burns prevented by the use of PROBAN-treated fabrics, but we believe that the social and economic benefit resulting from the use of PROBAN is very substantial.

DELIVERY UNDER EXCEPTION OF FIRES BREAKAGES OF MACHINERY STRIKES & OTHER UNFORESEEN CIRCUMSTANCES
ALL QUOTATIONS WITHOUT ENGAGEMENT

APPENDIX N

TELEPHONES
41231 & 2 DUNDEE
& 40381 DUNDEE

TELEX 76439
TELEGRAMS & CABLES
INGLIS DUNDEE

J·T·INGLIS & SONS LTD.

ROT RESISTANT : WATER RESISTANT & FLAME RETARDANT PROCESSORS OF COTTON : FLAX : CORE SPUN & JUTE FABRICS
MINISTRY OF DEFENCE CONTRACTORS LIST DEF. STAN 85-24

RIVERSIDE WORKS
DUNDEE DD1 3LU
SCOTLAND, U.K.

DIRECTORS:
IAN C LOW
T C SHEPHERD
SIR H V BONAR, C.B.E., LL.D
R C SCRIMGEOUR
T R ANDREW

YOUR REF

OUR REF

DATE 28th June, 1982.

Dear Sirs,

HEALTH AND SAFETY AT WORK ACT.

The proofings supplied by J.T. Inglis & Sons Limited do not, in general, present any health hazard but normal standards of hygiene should be observed in handling materials processed by us.

Our proofings do contain small amounts of chemicals, which by themselves may have some toxic or irritant effect, but this is greatly reduced in the combined state within the proofings. When handling these materials, care should be taken to avoid the accumulation of dust which might be subsequently inhaled and hands and face should be washed frequently, particularly before eating to avoid ingestion into the body.

If material catches fire, care should be taken to avoid inhalation of the fumes emitted, since in common with most organic substances, toxic fumes may be formed during combustion.

If any health and safety problem arises in connection with the use of our products, contact us immediately for advice and help.

Yours faithfully,
for J.T. INGLIS & SONS LTD.,

T.C. SHEPHERD.
Managing Director.

J. T. INGLIS & SONS LTD.

RIVERSIDE WORKS

DUNDEE

DD1 3LU

RESEARCH AND TESTING DEPARTMENT Date

Dear Sirs,

Health & Safety at Work Act 1974.

Manufacture of items on this contract involves the use of Cloth Duck Polyester and Cotton FWRR. The finish on this cloth may have amongst its constituents:

Antimony Oxide

Polyvinyl Chloride

Pigments

Chlorinated Hydrocarbons

LPCP

and possibly other additives

It is therefore necessary that the workplace has good ventilation and any dust which may include such above chemicals as are used in the finish, be cleared away frequently by vacuum cleaner to prevent accumulation. The dust may cause irritation to skin and lung if the exposure is prolonged. In addition to good ventilation protective clothing (e.g. cap, coat, and dust-protective facemask) and the use of barrier creams are advised in very dusty conditions.

Yours faithfully,
For J.T.INGLIS & SONS LIMITED,

Chief Inspector.

APPENDIX 'O'

PROGRAM SUMMARY

PROGRAM ELEMENT	ELIGIBLE PROJECTS OR ACTIVITIES	MAXIMUM CONTRIBUTION LEVEL			
		TIER I	TIER II	TIER III	TIER IV
Industrial Development Climate	a) Economic development studies; establishment of non-profit centres or institutions.	Eligible	Eligible	Eligible	Eligible
	b) Infrastructure related to industry.	Not Eligible	Eligible	Eligible	Eligible
Innovation	Consultant studies; development of new products or processes; technological capability; development and demonstration; design.	50%	60%	75%	75%
Establishment	a) Consultant studies.	50%	60%	75%	75%
	b) Establishment (35%)*	Not Eligible	35%	50%	60%
Modernization/ Expansion	a) Consultant studies.	50%	60%	75%	75%
	b) Modernization/expansion;	25%	35%	50%	50%
	c) Adaptation of microelectronic/ electronic technology.	50%	60%	75%	75%
Marketing	a) Consultant studies. Collection/dissemination of tourism information; special events.	50%	60%	75%	75%
	b) Market research and events to promote Canadian products for non-profit organizations.	Eligible	Eligible	Eligible	Eligible
Restructuring	a) Consultants studies.	50%	60%	75%	75%
	b) Restructuring (Repayable)	25%	25%	25%	25%
	c) Restructuring (loan guarantees)	Eligible	Eligible	Eligible	Eligible
	d) Participation Loans	Not Eligible	Eligible	Eligible	Eligible

* 35% support available for Special Tier I